

FAX MENTIS HONESTÆ GLORIA



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THE
Manner of Raifing, Ordering;
And Improving
Forest and Fruit-Trees:

ALSO,
How to Plant, Make and Keep
WOODS, WALKS,
AVENUES, LAWNS, HEDGES, &c.

WITH
Several FIGURES in Copper-plates, proper for the fame.
ALSO

RULES and TABLES shewing how the Ingenious Planter may measure Superficial Figures, with Rules how to divide Woods or Land, and how to measure Timber and other Solid Bodies, either by Arithmetick or Geometry, shewing the Use of that most Excellent Line, the *Line of Numbers*, by several New Examples; with many other Rules, useful for most Men.

By *Moses Cook*, Gardiner to that great Encourager of Planting, the Right Honourable, the Earl of *Essex*.

Whereunto is now added, that ingenious Treatise of Mr. *Gabriel Plattes*, viz. A Discovery of *Subterranean Treasure*

LOXDOX.

Printed for *Peter Parker* at the *Leg and Star* over against the
Royal Exchange in *Cornhill*, 1679.

1711

Journal of the ...

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WOODS, WALTER

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TO
HIS EXCELLENCY

Arthur Capell,

*Lord Lieutenant and General Governour of
the Kingdom of IRELAND,
Earl of Essex, Vicount Maldon, Lord
Capell, Baron of Hadham, Lord Lieu-
tenant of Hartfordshire, and one of the
King's most Honourable Privy Council, &c.*

May it please your Excellency,

DID I not very well know your great
Understanding in, and Love to the
Subject of the ensuing Discourse, I durst

The Epistle Dedicatory.

not assume the Boldness to implore your Honours Patronage of it; But being well assured, that you have not been onely a Spectator, but an Actor in most of what is treated of in the ensuing Lines; for, to your Eternal Prayse be it spoken, there is many a fine Tree which you have Nursed up from Seeds sown by your own hands, and many thousands more which you have commanded me to raise.

Therefore, my Lord, I humbly crave your Pardon for the Presumption and Imperfection of the Pen-man; and though your Excellency knows full well how to prune young Trees, yet I hope you will pass by the impertinent and superfluous Lines in this my Plantation; which, though I have endeavoured to keep as well pruned from Errors, and as clean from Weeds as I could, yet 'tis possible there may be some things in it, which
some

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some may term as ill : But to You all things in it are so well known, that I hope both it and I shall find such shelter and support by your favourable Aspect, as that we need not to fear the Storms of the ignorant or negligent Planters.

And my Lord, since the Art of Raising and Improving of Trees, hath ever been esteemed amongst the truly Noble, Wise, Ingenious and most refined Spirits of the World from Age to Age, and chiefly maintained and practised by them; and since this Property is Naturally inherent in You, (you being not onely a great Lover of this Art, but also most skilfull in it) I humbly presume to Dedicate these my Observations to your Lordship; not being ignorant, that he who is most knowing in any thing, is the best able to judge of the same; and that this my Opinion, of your Honours Ability and Promptitude in promoting the Planting and Improving

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proving of *Forrest-trees*, is surely ground-
ed, the Large Plantation you have made
will abundantly testifie. But I humbly
beg your *Lordships* Pardon for this Pre-
sumption, not without hopes that my
good Meaning may obtain it; and since
my good Wishes and the best of my Ser-
vices is all I can contribute to You, these
shall never be wanting from

My LORD,

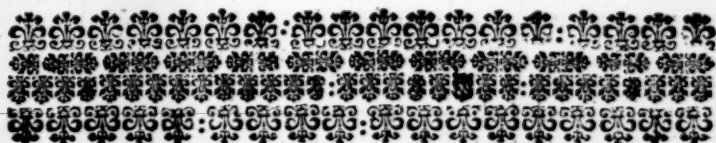
Your Excellencies most Humble

and most Obedient Servant to serve You

whilst I bear the Name of

Moses Cook.

TO



TO

The Courteous R E A D E R.

AMongst the many Books that are sent into the world in this Age, I have adventured to increase the Number by this one. I know there be many Pamphlets, prodigious Histories and Romances, invented by mens Fancies, which abuse many Noble Spirits, in reading of which they spend their time in vain, and dull their Wits : Which Books are more fit for Women than Men. For they will furnish them with strange Stories, and a few fine words. Also there be many Books of Disputes in Divinity, which tend more to make our Differences the greater, than any wayes to edifie or unite us : therefore if your Genius leads you to read such Books, this is not for your Fancy.

But if you take delight in Planting or Gardening, or to raise and improve Forrest-trees, or to make Walks, Avenues or Lawns ; to plant or improve your Woods, Hedges, &c. or to measure most sorts of superficial or solid Figures, either by Arithmetick or Geometry, with several other Rules of the same Nature, as the Titles of each Chapter, (but especially the Chapters themselves) will more fully inform you ; then I hope this Book will be of good use to you : For here are several Rules, approved of by several Noble and Ingenious Men, which are as faithfully delivered, as they are really intended for the good of this Nation,

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tion, and all those that will put them in practice; which if you please to doe, you will employ your time so well, that you will never have cause to say, it is ill spent; and if once you do but step forward one step, and see but any success of your Labours, you will need then no Logicians Arguments, nor no Rhetoricians Eloquence to perswade you to proceed. And for your better Encouragement know, that it hath been and is the Delight and Practice of Kings, Princes, Philosophers, and all Noble spirited and wise Men: For have not many of them quitted their great Employes, and taken upon them this pleasing Art of Planting and Gardening, as is proved by several? See the Prefaces of *Perkinson's*, *Gerard's*, the Curate of *Henonville's*, and several others. For Almighty God hath Imprinted in the Hearts of most wise men such a Love to Plants in part, as their Father *Adam* had in his state of Innocency; that those noble and usefull Works, which the Almighty made for the use of Man, and his Glory, should be the more common for their excellent use to the Sons of Men; and that they should take care of those which are tender, and want the more care, lest they should be lost; and also that both their Vertues and their Beauties should be known in several parts of the World, that he might be the more Admired and Glorified.

For I do believe that the Blessing of God is much Affisting to those who Love and endeavour to Improve and Preserve his Works; for God's Works and his Word are no such different things; and also it hath been and is observed, that those that are Wasters and wilfull Spoylers of Trees and Plants without just Reason so to doe, have seldom prospered in this World. See this confirmed by Esquire *Evelyn*, in his Preface to his *Discourse of Forrest-trees*. Therefore, you that are Lovers of Trees and Plants, if once you have them, let your Love be shewed in the Care you take of them, to keep them from Cattel and
other

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other Inconveniencies, then will you not onely have Pleasure and Profit of them, but others, by being defended from the malignant and sharp Air by their Heads and Bodies, and also shaded from the violent Heats, and their sweet Flowers, and their refreshing Fruit will be usefull to several men.

Also Planting and Gardening addes much to the Health and Content of Man; and these two Jewels, no man that well understands himself, would willingly be without: For it is not onely set down for a certain Truth by many wise Men, but confirmed by Experience. The Learned Lord *Bacon* commends the following of the Plough in fresh Ground, to be very healthful for Man; but more the Digging in Gardens, saying, *It is best to take the Air of the Earth new turned up by Digging with the Spade, or standing by him that diggeth*: He tells you also that he knew a great Man, that lived long, who had a clean Clod of Earth brought to him every Morning as he sate in his Bed, and would hold his Head over it a good pretty while, &c. See pag. 203. of his *Natural History*. For though the Earth be two-fold, External or Visible, and Internal or Invisible; the External is not the Element, but the Body of the Element, in which is the Sulphur, Mercury and Salt; for the Element of the Earth is Life and Spirit, wherein lies the *Astra's* of the Earth which bring forth all growing things; for it hath in it self the Seeds and seminal Vertues of all things; for as it is made fruitfull by all the other Elements, so it bringeth forth all things out of it self, as Trees, Herbs and Flowers; and every one of these is again the *Astrum* and Seed: See *Philosophy Reformed*, p. 38. Thus is shewed; that the Earth hath in it, the Virtues of all Herbs; it must then be also healthful as they be: But for that part of the Earth that is neer the Surface, the Plants suck most of its Virtue into them; therefore that which lieth deeper may be the more healthfull for Man to smell of

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for Consumption, Loss of Appetite, &c. And Trees do not onely catch the Mildew and other offensive Dews with their Leaves, but screen the Aire of other bad ones, and makes it much the healthfuller for Man. Therefore, you that live neer to Fenns, Moors, and other unhealthfull places, plant your Seats round with Trees, and some of those that yield healthfull smells: For it is very certain, what the aforesaid Learned Author saith, p. 204. *That Odours do Nourish*; for he saith, he knew a Gentleman that would fast three or four dayes, without Meat, Bread or Drink, by onely smelling to a great wisp of Herbs, &c. And in p. 44. in the History of his Life and Death, saith, *That Odours are especially profitable for the Comforting of the Heart*: And further he saith, *We commend above all other Odours, that of Plants growing and not plucked, taken in the open Aire, as Violets, Gilly-flowers, Pinks, Bean-flowers, Line-tree Blossoms, Hony-suckles, Wall-flowers, Roses, Mints, Lavender, &c. Orange-trees, Citron, Mirtils, &c. Therefore to walk or sit neer the breath of these Plants, would not be neglected.*

Thus you see this Learned man takes notice of the Line-tree; and if the simple Water that is distilled from the Flowers, be good against the Plague, or other infectious Diseases, as certain it is, then sure the smell from the Blossoms themselves must be very good; therefore excellent to plant neer your Houses: And (as I have heard) a wise Mans Opinion was, That the Line-trees in the Cities in *Holland* adde much to the Health of the Inhabitants; and it is my belief. I have hinted at the bigness of one Lime or Line-tree, in the ensuing lines, and shall here shew you, for your further encouragement to plant and preserve Trees, the Content of one Tree, as I had it from the Honourable Sir *Henry Capell* as followeth.

To the Reader.

A Witch-Elm in Sir Walter Baggott's Park in the County of Stafford.

Two Men five dayes felling it.

It lay 40 yards in Length.

The Stool five yards two foot over.

Fourteen Load of Wood brake in the fall.

Forty eight Load in the Top.

Eighty pair of Naves were made out of it.

Eight thousand six hundred and sixty foot of Boards and Planks.

It cost Ten pounds seventeen shillings Sawing.

The whole Substance was conceived to be 97 Tuns.

It was felled in the Year 1674.

And now I shall set before you some Rocks, which are in some Books, and for their strangeness are entertained too long, to the Abuse of many : But these which I mark here, pray endeavour to avoyd.

First Error: It is affirmed by some, that if you put your Seeds in a Box, Shell, or Squill, and so set them in the Ground, these seeds will unite in one, and so bring forth larger and better Fruit ; but if they should joyn in Roots or Branches, that will not make the Fruit the better or larger, nor of two kinds in Taste, as some have said. I rather think that putting seeds into such things will stupifie them and destroy them ; but if they should unite in one shoot, that shoot that groweth the fastest would lead all the sap into its Head, and so strain it through its Pores, that it would make no more Alteration of a Fruit, that such a shoot would Naturally have had, than a Graft doth by being grafted on several stocks.

For what Alteration there is of Plants, it is from their seed, and is stamped in them at their first Conception and

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Nativity, which the Art of Man helpeth and may improve somewhat, but never to alter the Kind, by Budding, Grafting, &c.

I shall not trouble you and my self in Answering these following Errors; but if you be not satisfied with my saying they are so, I shall answer them when you desire me, as well as I can: So I shall onely name them, and shew you them as I have found them.

Second Error: To water seeds with coloured water; or Plants, to make them produce what coloured Flowers or Fruit you please; It is in vain to think so.

Third Er. To graft or bud stone-Fruit, or Kernels, or Nuts, or to bud such Fruit as beareth Kernels on such as beareth Nuts or Stones; or to bud Fruit-trees on Forrest, and the contrary; or to graft or bud Figs on Peaches, or Apricocks; or to bud any sort of Trees on Coleworts; or to bud Peaches on the Mulberry-tree to have them Early; or to bud Damsons on Gooseberry, Mulberry or Cherries, to have them Ripe all Summer; or by budding Cherries on these Stocks, and to wet them in Honey and Cloves, makes them taste sweet and spicy; or by budding or grafting, to make a Fruit taste half an Apple and half a Pear, or half a Pippin and half a Pearmain; or an Apple half-sweet, half-soure; or to graft a Rose on a Holly; or to graft Cherries on other Stone-fruit to come without Stones; or to graft a Vine on a Cherry; or to take the Pith out of two Grafts, and then joyn them together and graft them, brings a Fruit without Kernels, so they may when both grow; or to graft a Cyon with the small End downward, will make it bring a Fruit without Core: These, and the like, are great Errors, and very false in Grafting and Budding.

Fourth Er. To set a whole Apple or Pear, the Pippins will come forth in one shoot; or to set any sort of Fruit with the fleshy part on; are also great Errors.

Fifth

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Fifth Er. To bore holes in Trees, and to put Honey or other sweet things into them, to make them bear more and sweet Fruit; is also a great Fallacy.

Sixth Er. To think that the Sap of Trees at the Approach of Winter falleth from the Head into the Root, is a gross mistake. Many more there are which I could count up; but these are too many, either to be written or kept in Memory.

Thus having shewed you some Errors, I here beg Pardon for mine own that are in this Book. I know I have committed Tautology; the Reason is, I have been long in taking true Observations: but I hope that which is so usefull, cannot be too often repeated. I have used Arithmetick the more, because it is so usefull to the ingenious Planter; for I have not laboured to please my self onely, but for all those that seek Wisdom: For the Gifts of God are improved by communicating, and Knowledge thriveth as Ingenuity is improved and communicated: for Ingenuity hath these Properties of Memory and Charity, the more you use it, the better it is; and the more you give of it, the more you shall have.

And now I shall shew you how I did proceed in that which I was born to, not made: I alwayes took Notes of what I did set or sow, the Time, and on what Ground, &c. and when it proved well, I noted it so; but when ill, I did endeavour as much as I could to know the Reason; which when once I found, I noted it well: I also alwayes was very wary of taking things upon trust; for many Learned men have abused their Works by so doing; and if any man told me any thing, unless he had sufficient Experience of it, or could give very good Reasons why it was so, I alwayes was incredulous of it, unless my Judgement told me it were possible, or he by Discourse made it plain to me: For no man ought to deprive another

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ther of the Liberty of Humane Ingenuity, that hath Light of Nature to discern and judge by.

I have often been blamed by Noble-Men, for not consenting to the Opinion of some of their Favourites; for when their Notions were not grounded on Reason, or had not been proved by Experience, (though never so new) I could not well entertain them. So if you find any thing in these few Lines, that hath not Reason in it, prove by Experience whether it is true or not: And do not say, It is so or so, because I say it; but as you find it. And let me be plain with you further; alwayes when I undertook any difficult business, I was as carefull as I could be, to elect a fit time to begin that business in: And to the prayse of God I speak it, I alwayes had the greatestt success in my greatestt undertakings, though many times I have been altogether Ignorant in them; and many times failed in small things, when I thought of the least danger. I know some will smile at this Truth, but let them laugh that win; I never lost by it. The wisest man that ever was, tells you, *There is a Time for all things*; and certainly there is in Sowing, Grafting and Gardening: For it shall be my Opinion,

*To think and judge as cause I find,
My Rule is not anothers Mind.*

Or as the ingenious Mr. Cowley hath it from the Learned Dubartas:

*Senseless is he who (without blush) denies,
What to sound Senses most Apparent lies;
And 'gainst Experience he that spits Fallacians,
Is to be hiss'd from Learned Disputations;
And such is he that doth affirm the Stars
To have no force on these Inferiours.*

But

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But to conclude; I have here shewed you some Rules how to prune Forrest-trees, which well done adds much to their shape, growth, and long life; Every one that makes any Observation of Trees seeth this truth confirmed in their shape; and though many are against pruning of Forrest-trees, yet it adds much to their growth; and if done by a skilful hand and at fit times, it adds much to the goodness of the Timber, though several (it's possible) will tell you to the contrary, for it is the borrower that things of trust, that is Truth's greatest Opposer: But to confirm the growth by pruning, take this Example: There grew a young Oak near the Orange-house at *Cashibury*, about nine inches Diameter, with many young Boughs on the sides, which robbed the Head so much, that it did shoot but little, having more boughs than the Roots could well maintain, I took off the side-boughs in the year 1669; and in the year 1675, My Lord ordered me to fell it, it standing too near a Walk we had made. My Lord being at *Cashibury* and discoursing of pruning Forrest-trees with the ingenious Artists Sir *Samuel Moreland* and *Hugh My* Esquire, I shewd them the Truth confirmed in this Tree; for that year it was pruned it did grow $\frac{1}{2}$ of an Inch, which was near as it had grown in five years before; It continued that growth very near for the six years after, as did plainly appear by Annual Circles to them and me. And as good Pruning doth help the growth of Trees, so also it doth prolong their Life: For it is well known that the pruning of some Annual Plants will make them live more years than one; for good Pruning may take off that which ill pruning hath left, or the wind, which otherwise would destroy the Tree in little time. And as I have said something in this Book of Pruning Forrest-trees, so I wish some able man would shew some Rules, or his Judgement of Pruning all sorts of Fruit-trees and Plants that bear Fruit, that there might be some light for a man to see to ground his

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his Reasons on ; for we are much to seek both in the manner how, and the Time when to Prune our Fruit-trees, both to Improve them and their Fruit.

† I also have shewed you several Rules of Artificial Arithmetick by the Canon of Logarithms, and several Rules of the Line of Numbers or *Gunters* Line ; which for their excellent uses cannot be made too common, or too well known to the Ingenious.

And Lastly, I have not bushelled my Light, but have set it to the Publick view ; which if it enlighten thee in the good and true way which I intend, to thy benefit and pleasure, it's possible I shall doe thee, if the Lord permit, some other piece of service, farther to direct thee in the Truth.

My request to thee is to Correct the mispointing, or paging, for my business is such, that I cannot see it Corrected my self, but trusting in your goodness shall conclude:

*Small faults if you'll pardon, and some amend,
Then I'll be yours to my Lifes end ;*

From Cashiobury near
Watford, Novemb. 16.
An. 1675.

M. Cook.

CHAP.



CHAP. I.

Of the several Ways of Raising Trees : The best for Forrest-trees is by their Seeds, Keyes, or Nuts, &c.

YOU may raise most sorts of Trees by Laying; the Ash being one of the worst, of any I have experienced : but it will take by Laying ; if you be an observer of the growth of the Ash, you then may read the Reason plainly, if that you keep but the eyes of your Understanding open, which I take to be this : Of all the Trees that I know, an Ash shoots with the straightest shot from his Seed, and so continues till it comes to a great height, unless by accident ; therefore seldom touching the ground by its own growth : But if it should, it having no Arms to defend it against Cattel, and they being great lovers of the tops and leaves, prevent its natural Increase that way, finding it self rarely or never encreased by this kind of propagation, it being not accustomed to Laying, therefore the harder to grow.

Your Oak will grow of Laying, so will your Elm very frequently, as I have seen in several Hedges, without any thing of Art : As you may see the great leaved Elm thrive well of a Layer on a bank by the Road-side from *Ware* to the Right Worshipfull Sir *Thomas Leventhorns* house called *Blacks-Ware*. It is worth your noting, to increase this usefull wood in your Hedges ; as also other sorts of Wood, which will be much for your profit, and also a great improvement to your Fence, though it be at present altogether neglected. Of the manner and several ways of Laying, see the *Fifth Chapter*.

2. Several sorts of Trees will grow of Cuttings; the Manner and Time I shall shew in the succeeding Chapter. But let me now invite you when you sell your Woods, to give some of these Cuttings Quarters in the Naked places, and you shall find them afterwards to pay you well for their Board : Remember your Hedges also where they want Guests to furnish them.

You may raise many sorts of Trees by the Roots, or part of Roots

of other Trees : The Kinds and Manner are shewed hereafter, which if you love your Woods and your self, you may take notice of.

3. Many sorts of Trees may be increased on other Stocks by Budding or Grafting, but this is more proper for Fruit-trees than for your Forest : For take it for granted, that it hinders the aspiring growth of Trees, and makes them bear more. I know my Lord *Bacon* tells you of Budding the Elm, and it will have greater leaves than ordinary : It is likely, if you bud the great-leaved Elm upon the small-leaved whilst it is young and full of sap, it will have larger leaves, especially than an old tree ; but that I judge signifies little.

Enquiry may be made, whether by budding the Elm and also the Line-tree, if it would not make their seeds keep better than they do many years with us : I wish it were tryed. As for the manner of Budding and Grafting, I referre you to other subjects, for there are many have written largely thereof.

4. The last and best way to raise your Forrest-trees, is by their Seeds ; and how to do that, I shall shew you in every particular Chapter, by me experienced. I wish every Noble-man or Gentleman that takes delight in these stately Monuments, would follow the Example of the Right Honourable, and very much knowing in these Lines, the Earl of *Essex*, who hath now several thousands of my Raising.

Let me be bold to tell you, that one Ash-tree raised in a Nursery, and ordered as is hereafter shewed, is worth five taken out of a VWood. For there you shall have them grow taper and strong, so that when you remove them, cut but off some of the side-boughs, and set them with great hopes of a stately Timber-tree. But if you take them out of a VWood, then will they be not so well rooted, nor taper, but top-heavy ; therefore you must be forc'd to take off the Heads before you set them, and then expect at best but a good Pollard ; and it is possible you may wait long before you get him to thrive : For the head being taken off, leaves such a wound which is long a curing ; which you must doe, or else his Roots will not maintain that Head. Ever let me advise you to be as sparing in taking off the leading top-shot of an Ash or VValnut as you can possible.

Thus have I shewed the several wayes to raise Trees ; for the performing of the same, read hereafter ; and this is certain, that a few of your Trees raised in a Nursery, are much better than those you take out of V Woods. My Lord was a little before I came to him at some Charge more than ordinary to raise some Oaks : Their way was to fence in a great Oak in the Park, and then digged the ground ; and when the Acorns were most of them down, then they raked them in : By this
Hus-

Husbandry, my Lord had got eight young Oaks about six year old: I perswaded his Honour to take up his Fence, satisfying him we should raise them at a much cheaper lay. He therefore ordered me to take up these Oaks very carefully: I having two Men then at work with me, I bid the elder goe and take up these Oaks, but could not get him to goe by no means; he also had posselt the other with such a tragical story, that I could not perswade him; which was, that there were few which took up an Oak, but either they or it dyed in a little time after. I told them that it was possible the Oaks might die in a short time, but they never the sooner. The Reason may be the same with that before, of raising an Ash by laying: It being not used to be removed, makes them the more difficult to grow when they are. But I went and took up my eight Trees, and lost Six of them the Winter following. Had they been taken up at two years growth, and the tap-root cut, you afterwards might remove them with little danger. I judge, if you can, it will not be amiss to save your Acorns or seeds of this Tree that hath been removed.

CHAP. II.

How to observe and know the Nature of Seeds, so as the better to raise them.

I Ever observed the shape, taste, skin or shell, that my Keyes, Nuts, Stones, Kernels, or Seeds had; and if I found by their shape, they were pory, and by feeling spongy, tasting little or very mild; I then did conclude to sow these sorts of Seeds as soon as they were ripe, or as soon at least as I received them; which if they were kept but a little after the time of their being ripe, I then expected but little success of those Seeds. To give you a taste of this Novelty, observe but these few among many more, that is, the Elm, Sallow, Popler, &c. and Angelico, Pasperc, or Garden Samphire, Scolanara, &c.

I know 'tis a Tradition, that the Elm and Sallow have no seeds: Then how could I raise several of them of Seeds, as I have done? But if you will not believe me, I pray you ask the Earl of *Essex*, or several others therefore.

*Be gone Tradition, never more appear,
Out of the Kalendar before next year.*

*Truth with Experience through this Nation
Shall Sainted be by a right Observation.
Leave room Astrologers for Truth, and see
You write it next year in your Diary.*

Now those Seeds that are of Taste mild, Skin or Shell close, you may keep them till the Spring approach, and longer, if temperately dried; and dry, keep as your Acorns, and your Chesnuts, &c. but the Spring after they be gathered is a sure season to sow them, therefore deferre no longer.

But as for your Seeds that are of a hot or bitter taste, or have close skins or shells, you may keep them till the Autumn following after they be gathered, if occasion be, if they be ripe gathered and dry kept, so the fleshy part be clean taken off when that is ripe: Though I know an ingenious person did hold, that to sow them with their flesh on, (as Peaches or Cherries,) they would grow as well, as he said; but that was his mistake: For the fleshy part was ordained by the Almighty for the use of Man, Beasts or Birds, and tends nothing to the growth of the Seed or Stone, but rather to its dissolution, by stupefying it, as I have tryed by sowing the Kernels of rotten Pears and Apples, which would not grow though but a little time rotten. There be many Stones, Keyes and Seeds which be of a hot and bitter taste, as your Ash, Peaches, Almonds, the Mizerion, Mustard-seed, &c. yet though I say they may be kept long, yet I advise you not to neglect your season; for many of these Seeds and others will lie near two years in the Ground before they come up: if you sowe them in *October*, it will be the Spring come Twelve months before they come up; and if you sow them Early in the Spring, they then will come up the next Spring.

Another way whereby you may know Seed of this Nature, is, by their long hanging on the trees: for there, Nature finding it self strong, taketh the less care to seek out early to preserve its kind, and also Almighty God hath made these very usefull for the Creatures in this world, therefore hath ordered it thus by his Divine Providence. The Ash, Holly, &c. hang long on the tree, and lie long in the ground, the Elm, Sallow, Sycamore, fall soon, and come up soon.

CHAP. III.

The Shape of Seeds and their Weight do Inform you how to set them.

THe very Form and Shape of Seeds hath instructed me how to set them: as an Acorn falls to the ground most with its small End downwards: Thus if they fall upon Mold or Moss, you may observe the most of them to be on one side, with the small end tending most to the Earth. And I suppose that this posture is the best for to set any Stone or Nut, if you will be curious: For if you observe any Seed, of what Tree soever it be that grows in *England*, first it puts forth a Root at the small End, and when that Root hath laid hold of the Ground, then it puts forth the shoot for the tree at the very same place where the Root came. Then seeing that both Root and shoot put out at the small End, if set with the small End downwards, the Body of the Stone or Seed may hinder the shoot, so that it is the best way to lay them on their sides in the Ground: if they be heavy seeds you may sow them the deeper, as Acorn, Peach, Apricock, Walnut, Chesnut, &c. about two or three Inches deep.

If light Seed, then cover them with but little Mold, as the Elm, &c. as an Inch deep.

To conclude then, lay the flattest side of your Seed downwards; as if it be a Peach stone, set it as it will lye on a Table, or the like, and it will lie with the Crack where the shell parts uppermost, and the other crack lowermost to let out the water, as I judge; for Kernels in Stones or Shells do not love too much water at first.

Thus have I shewed you the several wayes to raise Trees: That is, how they may be raised, and how to know the time, at least to assist you to know the time to set them by their shapes, &c. as also how to set them the best way by their Form and Weight, which may be some assisting to you, if you meet with far-Country seeds.

My Lord had thirteen sorts of strange seeds sent him, as I remember from *Goa*: I never saw the like, nor none that saw them here. By the help of those aforesaid Reasons, I raised ten of the thirteen sorts, though some of them lay almost a year in the ground: But I also must tell you I lost all my ten sorts the first Winter, but one sort, and that the second, for want of a Green-house: some of them I suppose were Annuals. I shall

shall give you one Chapter more of Seeds, and then I will shew you fully what as yet I have but named.

*O great Jehovah, thee I doe adore,
Thy works I do admire, and thee implore
So to assist me, as that I may write
With Solomon's Wisdom, that I may indite
My few lines so that they may be
Usefull unto this Land, pleasing to thee.*

CHAP. IV.

Observations of all sorts of Keyes and Seeds.

LEt your Keyes be through-ripe, or when you find them to begin to fall much, which is a sure sign of any Fruit or seeds Ripeness, (unless by accident) gather them off some young, straight, thriving tree: My reason of gathering them from off a young thriving tree, is, then will your Keyes or seed be the larger and solidier; therefore by consequence they be the abler and likelier to shoot the stronger, and to maintain themselves the better: And I know by Experience, that the seeds gathered of old Plants or Trees, or old seeds, so the seeds be perfect, will come up somewhat sooner than the seed of young Trees: my aforesaid Reason doth this somewhat demonstrate; or take it thus, Nature finding her self weak in these Seeds, doth (like a provident Mother) seek the sooner to provide for her weak Children; as a great Philosopher and Naturalist saith, That Nature is one in divers things, and various in one thing. See *Parad. pag. 90. of the Tree of Life.*

And to gather them off a straight and thriving tree, 'tis likelier they will run more up, and grow straighter than those which be gathered of Pollards. This I know, that Nature doth delight very much in Imitation, and in Plants and Trees like doth endeavour to produce its like: though I know, that by the scituation, or ground, or grafting of some sort of Stocks, that by any of these the trees may and will alter something, both in growth and largeness of Fruit, and earliyer, or the contrary, but the *species* will be still the same. To which I adde, good keeping or dressing of any tree, doth much improve its growth, and largeness of Fruit or Seeds.

Now

Now the Seed being that part of the Plant which is endowed with a Vital Faculty to bring forth its like, it contains potentially the whole Plant in it, therefore it may and is the more to be observed: Or as a learned Physician hath it, speaking of Man and the World; The Chaos or first Matter was made a World, and of this World was made Man: so a Tree groweth from the Seed, the Seed is the beginning of the Tree, and in every grain or seed of a Tree there lies hid another tree. See *Philosophy Reformed*, page 58.

The Industrious Farmer or Yeoman will take care that the Grain which he soweth be of the best Kind for Largeness and Goodness in every particular, and hath oft found by Experience to his loss, that the Corn which is taken to sow from that which was your smooted or mill dew'd, doth oft produce smooted or black Corn again; he knowing also that this black Corn which is like dust within, will not grow: Then what should be the Reason that that which growes in the same Ear will oft times produce black smooted Corn, that hath nothing but a little black dust in it, or a black flinty Kernel of little or no use, but harmfull to the rest, though that which you sowe seem sound, and a very likely berryed Corn? When I have found by Experience, that Wheat which hath not been so likely to the Eye as that which was freer from smooted Corn, hath brought or produced clearer Corn by much than the others. Now I have discoursed with some which would not spare to say positively, that your smooted or black Wheat would grow, and so produce black Wheat again, which is a great Mistake: But this I know, that your Wheat which is like black dust within, will not grow at all, nor some of your black flinty Wheat, but some of it will produce blades, some stalks, with ears, but no sound grain; some with good and bad in one ear, and so the nearer it is to perfect sound grain, the nearer it produceth its like: Yet though this may and will produce some good and some bad, as I say, yet no black smooted grain (unless meeting with some accidental Cause, if the Grain be perfect sound) but according to its defect so may be the success of your Crop.

Now this which I call the Accidental Cause, is the Mildew, which may well be so called, because of its Malignity, especially to Wheat and Hops, because in them most perfected, though many other Plants suffer as much: This Mildew or Mildew, is a Dew which is drawn from the Earth and Herbs in a drye and calm time, and when Herbs are in their prime, by the Sun: and wanting wind to fan off their grossness, and also being drawn from Herbs, which make it thick and sweet, and not so active to aspire: 'tis most in your inclosed Grounds and Valleys: and to those grounds which lie tending to the Oriental part of the Heavens, as all Blasting winds are.

Now

Now I suppose these may be the Reasons your Valleys do afford more moisture than your Hills, as is oft seen by your Mists which are more frequent in them than on Hills: this being drawn up by the Sun in the Day-time, and wanting wind to assist its Motion (as I said before) doth hang in the lower Region, and when the Sun sets, it falls upon your Plants with its thick clammy substance; and in those whose bark is tender and young, and pores open with the heat of the season, hinders the sap of the Plant or Tree to ascend to nourish his flowers or shoot. 'Tis observed, that when your Wheat doth shoot up to Ear and flower, it doth it suddenly, and likewise your Hops, and then this Clammy or Mildew coming upon it before the Air hath hardened it, to resist it; For the Air being warm, Nature doth not so much as dream of this unkind Enemy: And if it falls on Wheat when the Ear is new formed, then there is the black' smooty Wheat; but if the Ear hath blown even when or before it comes, or that the whole stalk be not surrounded with it, then you shall have some of your grains good, and some bad, according as they were in setting, or find Nourishment.

I have oft observed in your black Heart, white Heart, and other great-leaved Cherries, this Dew to fall upon them at the top, just at the beginning of *Midsummer* shoot, and hath so stopped the shoot, that it hath shot forth in other places below; and on the top of the shoots you may see many little Flies feeding on this Dew; and on the Leaves of Oak and Maple, 'tis plainly to be seen and tasted; and though destructive to Corn, &c. yet it is mighty Relief to the industrious Bees.

The Reason why those grounds which hang from the Horizon to the East, are most subject to this Dew, and to Blaiting, as it is termed, may be (as I judge) the Suns drawing these vapours towards it; just as a great Fire draweth the Air in a Room to it so the Sun having set these in Motion, yet not having strength enough to draw them into the middle Region, to form them into a Cloud, doth yet draw them till he is below our Horizon, then these Dews tend to the Earth from whence they were taken, and in motion to the West do as it were fall upon that Ground which hangs Eastward at right Angles, therefore offensive to them most.

But since I am speaking of this usefull Grain Wheat, I shall take notice of that which I know is used with good success: They take their Seed-wheat, and steep it twenty or twenty four hours in water and Salt, which is found by experience to do good to the Wheat against the blackness, and helps it in its growth; the Reasons I conceive are these: The steeping it prepares it for its spearing, and makes it take root the sooner; there-

therefore if late in sowing, steep the longer; if early, not so long: And if there be any Grain that is not perfect sound, this will either kill or cure it. And I suppose that Brine to Wheat, is as Sack to a young Child, a little doth a great deal of good; but have a care you do not let it lie too long in a strong Brine, lest you stupifie it, or kill it with too much Kindness. I do advise my Countrey-men, if late in sowing any of their Grains, to steep especially Barley, as well as Wheat; if your Grain be spear'd, it is never the worse, provided you sow it before the spear be chill'd or dryed; therefore commit it to the Ground, and cover it as you can. Your Wheat, Oats, and Barley differ much in their growth from other seeds; for they put forth their roots at the great end, and then one blade or long leaf at the small end, which comes between the skin and the body of the seed. Your Beans and Pease put forth their Root at the side, and then the same sort of Leaf, at the same place where the Root came out, that grows on the stalks.

So doth your Walnut, Chesnut, Horse-Chesnut, Peaches, Almonds, Apricocks, Plumbs, &c. and the onely difference from Beans and Pease, is, that these Stone-fruits put forth at the small ends, and the other alwayes at the sides.

In like manner there be several sorts of Trees, and most sorts of Plants that be small, which put forth Root at the small end; and as soon as that Root hath laid hold of the ground, they then send out two false Leaves, nothing like those that grow on the Tree or Plant, which two false Leaves are the seed, which divides into two parts, and so stand some small time on the top of the ground: and then between these two false Leaves comes forth a Shoot, which produceth leaves like those of the Tree or Plant from whence it came. Of this way of growth, there be an infinite number both of Trees and Plants, as the Elm, Ash, Sycamore, Maple, Pear, Apple, Quince, and the most sorts of the seeds of Trees which are not environed by Stones or Shells: of seeds, the Melon, Parsnip, Carrot, Carduus, Angelica, and indeed most sorts of seeds.

CHAP. V.

Of the several ways to raise Forrest-trees, or others; and how to perform the same by Laying.

THose sorts of Trees which will grow of Cuttings, are the easiest to raise by Layings, some of which sorts you may see in the next Chapter.

Now touching the best time for laying your Layers of Trees observe, that if they be Trees that hold their Leaf all Winter, as Firres, Pines, Holly, Yew, Box Bayes, Lawrels, Elix, &c. Let such be laid about the latter end of *August*.

But if they be such as shed their Leaf in Winter, as Oak, Elm, Line, Sycamore, Apple, Pear, Mulberry, &c. let such be laid about the middle of *October*. I do grant that you may lay at any time of the Year, but these times I take to be the best; for then they have the whole V Winter and Summer to prepare and draw Root in, at that time of the year the Sun having so much power on the sap of the Tree, as to feed the Leaf and Bud, but not to make a shoot: and if that little sap that rises, be hindred, as it is by some of the following wayes of laying, the Leaves and Buds yet gently craving of the Layer, makes the Layer prepare for Root, or put forth root a little to maintain it self, being it finds it cannot have it from the Mother plant: and being it wants but little Nourishment at that time of the Year, I think it is better to lay Layers of Trees, and to set Cuttings, than at other times: In Summer when the sap is much abounding, or in V Winter when the sap stirs little, or in the Spring when the sap begins to rise; for then it comes too suddenly to draw sap from the Layer before it hath drawn or prepared for root: for Nature must be courted gently; though I know in small Plants, the Spring or Summer doth very well, for they being short-lived, are therefore the quicker in drawing root: and besides that, Trees are many times laid, as they are not.

As for those Trees that are apt to grow of Cuttings, take but some of the boughs, and lay them into the Ground, covering them about half a foot with fresh fine Mould, leaving them with the end of your Layer about one foot, or a foot and a half out of the ground, keeping them moist in Summer; and in Twelve Monthstime you may remove them if rooted, if not, let them lie longer.

Another way is, take a Bough you intend to lay, and cut it half way through right crosse the wood, then slit it up towards the end, half a foot, or according as your Layer is in bigness, lay the slitted place into the ground, and you shall find that slitted place take root, if laid as the former, and so ordered. This way you may encrease many fine Flowers and small Plants, but they being out of my Element at this time, I shall not speak of the ordering them, for fear I seem tedious to some.

Another way to lay a Layer of a Tree, is, take a piece of VVyer, and tie it hard round the bark of the place you intend to lay into the ground, twisting the ends of the VVier that it may not untie: prick the place

place above the VVier thorough the bark with an Aul in several places, then lay it into the ground as the first.

A fourth way of Laying of trees, is, Cut a place round, about one Inch or two, where you find it most convenient to lay into the ground, and so proceed as is shewed in the first way of Laying.

A Fifth way to lay some sorts of Trees, is, to twilt the place you intend to lay into the ground as you do a withe, and lay it as is shewed in the first way of Laying; by this way and the first, you may furnish your Woods and Hedges: For they being easie, any ordinary man will perform the same. Thus you may from one Stub, as a Sallow, or the like, between one Fall and another of your VVood, for a Rod square of Ground and more, (if that one Stub produce but strong shoots) fill it well with Wood: For when the Stub hath got two or three years shoot, then lay round it, as before at large is shewed, there letting them remain to produce new Stubs.

But if you would increase by laying some young Trees from an high Standard, whence you cannot bend the boughs down to the ground, then you must prepare either Box, Basket, or Pot, and fill them full of fine sifted Mould, putting a little rotten VVillow-dust with this Earth, for that keeps Moysture to help the Layer to draw root; then set the Pot or Box thus fill'd with Earth, upon some Tressel or Post, as your Ingenuity will direct you, then lay your Bough by the second, third, or fourth way of Laying, leaving not too much head out, because the wind will offend it if you doe; and by its own metion be likely to rub off the tender young Root; and thus lay your Hops this way. These things observed, you may raise many choyse Trees, as Mulberry, Horse-Chestnut, &c.

These Rules may instruct you sufficiently concerning the propagation of Trees by Laying; but let me tell you, it is hard to raise a fine straight Tree by a Layer, or Cutting: I have hinted at the Reasons before.

Note, the smaller your Boughs be, Set them the less out of the ground, and keep them clean from VVeeds, that they spoyle not your Layers.

Also note, that the harder the VVood is, then the young VVood will take root best, laid in the ground; but if a soft VVood, then older boughs will take Root best: Now you that be Lovers of wood, make use of these sure Directions, and if you repent, then blame me.

CHAP. VI.

Of those sorts of Trees that will grow of Cuttings, and how to perform the same.

IF your Ground be moist you may Set with success any sort of Willow, Sallow, or Osier, Alder, Water-Poplers, any sort of Apple that hath a black burry Knot breaking out of the Boughs; that Knot, if set a Foot deep in good Ground, and the top a Foot out, is apt to grow: Some sorts of Wildings, Codlings, Gennittings, some Sweetings, the smiling Willow, Quinces, Tamarisk, Lawrel, Firr, Box, &c.

The time that I have spoke on for Laying your Layers, is also the very best time for Setting of Cuttings, which you may see in the fore-going Chapter, to be in *August*, for those sorts of Trees that hold their Leaves; and *October* for those Trees that cast their Leaves in Winter.

Those sorts of Trees that do grow of Cuttings are common, therefore you may take your choice the better for the bigness of your Cuttings; which I Advise you to let be from half an Inch to one Inch Diameter: If they be less than half an Inch Diameter, then they will be weak, with a great Pith, which Pith will take wet, and be likely to Kill your Cutting: And besides, when your Cuttings be so small, they be not prepared with those pores, (as at present I name them) that is, little black specks on the Bark where the Root breaks out, I suppose, if Set in the Ground; or else Almighty God, for a Sign to shew Man that those that have that Mark upon them, will grow as your Elder, Alder, Sallow, Water-Poplers &c. hath; and also if they be Young, they then have not that burry Knot, which is very apt to take Root, as your Codlings, and some sorts of Apples have; in hard Wood, the Younger the better: But if they be greater than one Inch Diameter, then the top of your Cutting will be long in covering over, therefore may somewhat decay your Cutting by the wet lying on the Head so much.

But you may Set your Willow and Water-Popler of a greater size, because they be Set for Pollard, where Cattle come, therefore they must be great and high, to be out of their harming the sooner; but the other size is most proper for your Hedges and V Woods.

If you set them by a Crow of Iron, or by an Instrument which they have about *Cambridge*, that bores a hole in the Earth, somewhat like to an Auger; Let the foot be free from cracks, cut smooth at bottom, and the
top

top of your Cutting the like, but let your top be slanted off; take care you do not rub up the Bark when you set your Cuttings; therefore make your holes large when you set them, and ram or tread the Earth close to them, keeping them moist the first Summer; and let the slant cut off the Head hang downward, and if your Cutting be choise, put a little soft VVax on the Head and Foot to keep out Air and VVet.

VVhen you set any Tree or Trees in your VVoods or Hedges, be mindful to put in one or two Cuttings with them, it will not be much time lost to do it, but well spent, as I have often proved.

C H A P VII.

Of such sorts of Trees as may be Raised by the Roots of another Tree; and how to Raise them.

AS for such sorts of Trees which may be Raised onely from part of a Root of another Tree, there be many; but of those that I have made Experience, I shall in this place give an Account.

First, Let the Tree be a thriving Tree, but not too Young, nor an Old Tree: For if it be too Young, then the Roots will be too small for this purpose; if too Old, 'tis possible the Roots may be a decaying, and then not fit for this purpose.

Let the Roots be from a quarter of an Inch, to an Inch and a half Diameter, and from some Young thriving Tree is the best, for in them the Sap is plentiful, and therefore will put forth the greater shoot: then in the latter end of *February*, or the beginning of *March*, digg round the Trees you intend to increase from, till you find such Roots as before are mentioned, and taking your Knife, cut them three or four Inches from the great Root, smooth at the place you cut off; then Raise up that end, putting in the Earth to keep it up, that when your Ground is levelled again, the end of this Root so cut off, may be two or three Inches above Ground.

I do Judge the fore-said time of the Year to be the best, for then the Sun hastning to the Vernal Equinoctial, or rather this Star of the Earth, to *Libra*, the Sun having heat, and a stronger drawing faculty on the Head of the Tree, draweth by its secret influence on the several Branches on the Head, and the Head from the Body, and both Head and Body from the Roots; and the Roots being furnished with Sap from the Earth, to supply the Body and the Head, is then the fitter to produce with that Sap a

new

new Tree likelier than when 'tis in its full Sap, *viz.* in Summer; for then the abundance of Sap will rather choak a Bud, than produce one out of the Root, if the Root be of such sort as will produce Trees from part of the Roots; and then the Weather is so hot, that it suffocates a new Bud that will be so full of Sap, as that will be, if any: and as to the opening of the Roots at that Season, how unnatural 'tis to the roots of the Mother-Tree, you may easily Judge.

And then, to do this in Winter, though there is a continual Motion and Ascending of the Sap from the Roots (unless Accidentally hindred by Frosts) all the Year long (for Nature is no Sluggard) yet to cut the Roots then, and to expose them thus cut, as afore-said, to the extremity of the Weather, which then usually is great, the Frost and VVet pierce that new wound so much, that 'tis more likelier to Ruine, than to Increase its Kind; but if it doth Live, the Spring is the time when it will Bud; therefore by Consequence the best. My Reason for cutting the Root two or three Inches off from the great Root is (then) that two or three Inches of the Root will put forth many Roots at the end, especially if smooth cut off, and so the better for the Tree from whence you take the Roots. Thus much for the manner of Raising by part of Roots; the Kinds which may be thus Raised, are these that follow, *viz.* Elm, Maple, Poplar, Aspen, Abete, Cherry, Crab-tree, Plumb, VVhite bush, Serves, &c.

CHAP. VIII.

What Soyl, or Dung is best for Trees, or their Seeds, &c.

ANY sort of Dung that is very hot of it self, as Pigeons, Hens-dung, Sea-Coal, or VVood-Ashes, Soot, or Malt-dust, such or as heats after 'tis laid in the Ground; as Horse-dung, and Horse-Litter, or Green Grass, or VVeeds: these or the like, unless a small Quantity, and in very cold Ground, are better saved than used for Trees, especially Forest-trees; some Reasons may be given for this. First, their Fore-Fathers have not met with such Kindness, therefore their Children do not, nor cannot digest it so well. Secondly, these sorts of Dungs are good for several sorts of Plants, especially Annuals, for 'tis the Nature of them, where they meet with such warm Entertainment, to come up the sooner, provided the Dung be not so hot as to burn them; for Nature hath accustomed

customed them so much to a Yearly decay, that the Seeds of them will lay hold of the first Opportunity, and put forward for their Journey, either Spring, Summer, Autumn, or Winter; according as they meet with Provision for their Progress, till they have Accomplished that which was done for them, *viz.* produced Seeds.

When your Forrest-Tree knoweth its continuance to be long, and that Naturally it hath many Years to produce its like, it will not be much forced by Art or Artificial means; for who can by the best Art or Care that can be used, force the Keys of an Ash to come up in a Year, or to grow but one Inch? For it will lie a Year or more before it will begin to shoot; when as several sorts of Annuals will at any time of the Year come up in three or four days, if their Entertainment be accordingly. Therefore neither your Forrest-trees nor their Seeds require much Dung, but love a ground Trenched deep with some Addition of fresh Earth, such as they delight in; as if your Ground be a strong Clay, then trench it deep, and mix it with fat Sand, Rubbish of Buildings, Sea-coal-ashes, Highway-Earth that hath drift Sand in it, or small Gravel-Lime, or Lime-Rubbish, &c.

And if your Ground be a Gravel or Sand, then trench it and mix it with Loom-clay, the turf and upper part of each is very good, digging the Ground deep, and mixing it well: But if it be for an Orchard, you may add to any sort of Ground; some rotten dung of Horse or Cow, &c. will do very well, so it be not where your Root is; but set the Roots of any sort of Trees in fresh fine Mould.

In stiff Ground it is good to trench it with Straw, Thatch, Litter, Woodstack-Earth, or small wood, but let not your Roots stand upon these by no means, nor upon no dung or turf, but let them be at least one Inch or two from every Root; and then in a Year or two, when the Roots of your Tree comes to this Dung, or Soyl, the Ground will then have made it rotten and fit to lead your Root along in the Veins as it lieth for them, to find their Nourishment the better.

Note, that those Trees whose Roots run shallow, do most delight in light Ground, as on a Gravel your Beech, Cherry, Ash; if mixed with Loom, the Elm or any; on a Brick Earth the Oak, Elm, Pear, &c. But for these I shall refer you to each particular Chapter of their Kinds.

Of all sorts of Ground for Trees, or most sorts of Plants, I take your Clays to be the worst: that is, your strong blue, strong white, or strong red; but if any of these have some stones Naturally in them, they make them the better; and the nearer they turn to a mixture of Loom, they be so much the better: So likewise Gravellý or Sandy Ground, the nearer a Loom the better; for a Loom, that is, a light Brick-Earth, is the most Natural

Natural Ground for Gardens or Plantations that is.

Your strong Grounds are worse for Trees than your light, especially for their Seeds ; for they be more subject to great Weeds, as Couch-grass, Thistles, Nettles, &c.

When your Gravelly Ground hath in most places a short Grass, or Mother of Thyme, or Moss, commonly the greatest Plant is Fern, which is very Natural to Seeds of Trees, and to the Roots of Trees : You may often see several Young Trees come up in Fern, which Naturally grows on your light Ground, therefore is most Natural for the increase of wood : But your strong Ground doth most commonly produce the greatest Oak, and your Gravelly or shallow Ground the finest Grain ; that is, when Trees are on such Ground as they do Naturally Love to grow on, they then produce the greatest Grain, for then are their Annual Circles the greater ; therefore such Trees are your strongest and toughest Timber. But when a Tree grows on a Ground it Naturally doth not like, then the Annual Circles being small, the Grain of such a Tree must by consequence be finer, and the Wood not so tough ; so that these stately Trees do not love such great variety as your Annuals : For if they be in a Ground which they do not very well like, if you give them but room by deep and often digging, they will then search the further from home, and provide such Nourishment as will make them thrive, and be stately.

When as your Annual Plants, and others that be not very long Lived, they will desire better, and more variety of Dung than your Forreit-trees. I have often admired what should be the Reason that some Plants will not come to their perfection, unless they stand on Dung, or that which will give a great heat ; which would kill the Seeds of several others, did they but stand there one day : But as for the Reason of the heat that such Plants desire, it is because they were made for hot Countries, and therefore if we would have them to come to Maturity in our cold one, we must give them warm Lodging, especially in the Spring, which is too cold with us for them : but what is it then that Plant does feed on ?

But then to consider well this, why the heat of Grass or green Weeds should bring them forward as well as dung of Horses, provided you can keep it but as temperate (for 't is subject to be too hot) and as long lasting, for it will not keep its heat long : where is then the salt, Sulphur and Mercury or Spirit in the Dung more than in the Grass to feed these Plants ? Also I have Observed, that if you take Rich Mould, half or more of it rotten dung, and cover one end of your Bed with ; the other end cover the same thickness with poor hungry Mould, provided you make it fine and fit for the Roots to run in, this last shall do as well, and many times better for any seeds on a hot bed, than the Rich Mould : Where is then

the salt Sulphur, or Mercury in the rich Mould, more than in the hungry, as most do hold, that the richer the mould, the more of them, and that all Plants draw their Nourishment from these matters; when I know that the seeds (most we sow on hot beds) could well digest that matter in the rich Mould, if it were there more than in the pore, and come on much forwarder in these Molds, each, if not on a hot-bed: the rich Mould would bring on Plants much stronger than the poor, provided the seeds be of such Plants that are quick of digestion.

Pidgeons dung sown thin upon cold Land, and early in the Spring, is very good for Barley: But if sown late, and on dry hot ground, it will then do more harm than good, for it will burn up your seeds or plants: this dung is too hot and quick for the seeds of Trees; for 'tis the nature of Pidgeons to eat Salt, and to go to the sea-side early in the Mo'nings, and there to pick up Salt, which the heat of the Sun makes by drying up the salt water, and then leaving the salt upon the sand. Now this Fowl feeding so much upon salt, the dung of it is hotter and saltier than any Fowl I know: Now the Reasons why it is good for cold Lands, and withall to sow it Early, are these: Every one knowes that 'tis the Nature of salt, that the dryer and hotter 'tis kept, the more it keeps its own Body, and doth not turn to water: And when it stands in a cold and moist place, it then dissolves in a little time to water; and when 'tis turned into this Element of VVater, then is it fit for the nourishing and feeding of seeds, especially Annuals: For they be alwayes prepared to set forward in their Journey, provided they meet but with suitable Entertainment. But the seeds of most Forrest-trees, they will stay the time that their and our great God hath allotted them.

But then why Salt should be a feeder of Plants or Seeds, I take the Reason to be this, namely, Salt water; (yet I do not mean of Salt in a great quantity, and in meet places that will turn it into water.) I have oft observed, that Salt if fallen upon a Board or other place, it will be long a drying; and if Heat have made it drye, then Dews or Rain make it moist again, then it steams forth, and that it is which nourisheth all Plants: VVhen if on a hot and dry ground, and late in the Spring, if dry weather come, then it doth not nor cannot yield its steam or fume, as *Paracelsus* in his Philosophy to the *Athenians*, lib. 3. p. 57. saith: Every Body or tangible substance is nothing but a curdled fume; whence (saith he) we may conclude, that there is a manifold Coagulation, one of VVood, another of Stones, a third of Mettals, but the Body is nothing but Fume, smoaking out of the Matter or Matrix in which it is. So that which groweth out of the Earth, is a fume, rising out of the

Moyſture of Mercury, which is various, and ſendeth forth ſeveral fumes for Hearbs, Trees, &c.

I do remember when I was a Boy, about fourteen years of Age, the Sea brake a bank into a Maſh of my Fathers, in *Lincolnſhire*, and did over-flow that Maſh and ſome others with ſalt Sea-water; the next Summer proving dry, all our Graſs was clearly burnt up, ſo that I was very much concerned for ſome particular Reaſons, thinking that all our Graſs had been quite killed, and indeed ſo it appeared: The next Summer proved wet, ſo that towards the latter end we had ſome Graſs again, and the third Summer we had Graſs enough, but the fourth and many after in abundance. So that it appears, the ground was ſtupified with too much Kindneſs at firſt, but after the Rain had allayed the too much ſtrength of the Salt water, then the Graſs could well digeſt the gentle Fume: I would have thoſe that lay Salt on their Gravel-walks to kill their weeds, obſerve if in a few years more they do not produce more weeds than ſome other that had not Salt laid on them at all.

Sea-ſand is a very good Compoſt for Ground, eſpecially for ſtiſſe Ground, for there it doth the too main parts to plants, or any ſeed or tree; that is, it makes way for the tree or ſeed to root in ſtiſſe ground, and makes a Fume to feed it: but this is too nimble for the ſeeds of trees, (unleſs a very little) obſerve the Reaſons before.

Mault-duſt is a moſt excellent Compoſt in a ſmall quantity, for many ſorts of Annual ſeeds, as I have oft tried with good ſucceſs; but the Reaſons are ſtill the ſame: for this being a ſmall part of the roots of the Barley, and being very dry, drinks in the Element of water, which is the principal and firſt matter of all things, (as a learned Author hath it, in the *Genealogy of Minerals*, p. 44.) So wonderfully hath God created VVater, the firſt Matter of Nature, which though it be ſo tender and feeble a ſubſtance, yet from thence is created the moſt ſolid and durable Fruit: that is, from the fume of an Oyly, Earthy water, is the Life of all Plants. The parts of the duſt being thus filled, upon the Suns attracting that and the Plant, the Root embraces this Fume: This little root, it having not life to grow, turns to Earth, and its Grave is a room to lead the root of another Plant in: it will give good entertainment to its own Kind.

Thus you ſee, the Deſtruction of one is the increaſe of another: A little of this is good for ſome ſeed of Forreſt-trees; but ſow it not too thick, for any thing, leſt it mold, or turn Muſty.

Note, that the place which is beſt for the root to be in, when the Tree or Plant is growing, is, the place that bringeth it ſoonest to Deſtruction

struction when dead, and contrary: for a Tree cannot live in water, or alwayes dry, and those preserve the Timber longest when the Tree is dead. This may be further improved by ingenuity.

Note also, that the place which is best to keep the Fruit of a Tree in, is the very worst for a Tree or Plant to grow in, and contrary.

Old Rags of Woollen Cloth, as is found by Experience by the industrious Farmer, cut into small pieces, are a good Compost for their Ground: they draw the Dew and Rain to them, and keep it till Sol's presence makes it fit for the Roots of the Plant: I judge them to be best for a pure dry soyl, because they hold their Moisture long, and I suppose 'tis a soyl that is lasting; for Wooll will not rot with wet suddenly. A little of this for the Trees or Seed on a dry Ground, will do good to them, as appears by the aforesaid Reasons: For Annuals better.

Conny-clippings are of the same nature (but I do suppose they will not last so long) and are better for a stiffe ground.

Saw-dust, if well rotten, and of soft woods, is very gratefull to the tender Roots or Seeds of any fort; 'tis good for dry ground, for it holds water, and makes way for the Roots of Trees very well, and is as good as most Preparers are.

Rotten-dust out of hollow Trees, especially those of soft wood, is a rich Leader of tender young Roots: the Reason is shewed before.

Soot is good to kill Moss, for its heat kills the Roots, for they lye on the top of the Earth: and good also to keep worms from doing harm to your Seeds.

Sea-coal Ashes are very good in cold stiffe ground, either for Trees, or any other Plant, to make that ground work well, and to keep it hollow for the Roots to run in, &c.

Rubbish of Buildings, that is, broken Bricks, and Stones and Lime is very good for the Roots of Trees in a stiffe cold Ground, the Reason is told you.

Chalk broken small into pieces, is a very good Compost for stiffe cold grounds. There is much difference in Chalk, but that which is soft, fat Chalk, is good for such Ground as aforesaid, and for ground that is not very stiffe. Let your Reason instruct you further.

Lime is a very rare Compost for cold Grounds, and stiffe Claves, for its heat causeth a fume, and its tenderness makes way for the Roots, to fetch home their Nourishment, and its heat is great at first, therefore lay not on too much on no ground; and let that be slacked. If your dry ground be it your Tree delight to grow in, and you are forced

to set them on wet, then adde some of this Lime among your Earth.

Clay, especially that sort which is a light Brick-Earth, is very good for such Land that is a light shovey Gravel, or hath too much sand in it: Such grounds as these, they do not retain the Spirit of Plants: for when Nature hath by the two Lovers, Star-Fire and VWater, generated their Babe, such ground as this doth drink down too fast, and again doth drye too hastily; so that the water cannot have time to leave nor to prepare its slime; which is the Mercury that makes that summe which feeds all Plants and their seeds: But this Clay must not be digged too deep, for then it wanteth of that which feedeth Plants, &c.

I have taken the green Slime that is common in standing waters, (I do not mean the Frogs Spawn, which is cast many times into this) and have dryed it and beat it into fine dust, and then have mixed it with good fresh Earth, and have found very good success in raising several sorts of Flower-seeds and others: Though I have Notes of them, yet it is out of my Road to speak of them now, being I am Writing of the stately Forrest-trees. However, I may (its possible) write somewhat of them, if the Lord permits, and according as I find these few Lines Accepted of by some of the Royal Oaks of this our Age.

For I do suppose that there is not one thing in Gardening yet well known: For (as a Learned Author hath it.) *he that knows a thing well, must know what it was, is, and shall be*; Therefore all humane Knowledge is but a shadow of superficial Learning reflecting upon mans Imagination, but not the least thing comprehended substantially.

But to the business in hand, take Clay or Loom, and lay it on your Ground, not too thick, the beginning of Winter, and there let it be till the Frost hath made it fall into Mould, then in some dry open time harrow it all over: and if it be Ground you plow, then plow it in a drye time, but if it be Ground you trench for Forrest or Fruit-trees, observe to order it so: for by thus doing the Clay will mix with the Sand or Gravel much the better: The better that any man cheweth his Meat, it is certainly the easier to digest; and the dryer you put it into your ground (provided it hath but time to water it self well before your trees be set) 'tis the better; for then it draws the Mercury, and stores it up till the Roots have occasion for it: for 'tis quickly exhaled out of sand: but the Clay holds his store till a time of Necessity, and then contributes to the Roots, that is, in drye weather: and the smaller you make it to mix with your ground, the likelier the small Roots (as well as the great) are to meet with it.

Note further, that the smaller your Plants be, the finer must your Earth be made, by skreening, sifting, beating, turning, &c.

I know by good success this to be true: for the Right Honourable my Lord (and the more to be honoured because a great Planter, and as great a Lover thereof) gave me order to make three Walks of Line-trees, from the New Garden to the New Bowling green, and withall to make them descend towards the House, as neer as we could; which to doe, I was forced to cut through one Hill thirty Rod, most of the Hill two foot-deep, into a sharp Gravel, and the greatest part of all the length of the Walks was the same; they being Trees that I raised of Seeds, most of them, and the rest of Layers, at *Hadham-Hall*, they being with my Lord ever since their Minority, and he many times their Barber, engaged him to have the more particular Kindness for them, therefore he ordered me to doe what I thought good in preparing the ground for them: which I did as followeth.

First I levelled the Hill, and when I had brought the Ground neer to the Level concluded on, I staked out my ground where every Tree should stand, and then ordered my holes to be made for my Trees, each hole three foot-deep, and four foot-wide, being the ground was so bad: This I did neer a Year before I set my Trees, and having the convenience of Brick-Earth near, I got near a Load to every hole, and mixed this with the Earth digged out of the Holes, turning it over twice, and in dry weather throwing out the greatest Stones, but the Turf I did throw into each Hole (the grass-side downward) as soon as they were made; but the Hill of Gravel I trenched that with Loom, Cow-dung, and the Litter under the Cow-racks, two Spade deep, and five foot on each side every row of Trees.

Thus having prepared my ground, and the season of the year come, about the beginning of *November*, 1672. I had the Trees taken up with good help, as carefully as I could, and carried to *Cashibury*, the place of their now Abode; and then having good store of help, and good Mould prepared, of the smallest and finest, I set the Trees with the upper part of the Roots of each Tree level with the top of the Ground, making a round hill half a foot high about every tree, and the Compass of the Hole.

Having pruned the heads of each Tree, and cut off the bruised Roots, and the Ends of such roots as were broken, I sorted the Trees, and observed this Method in placing them, namely; I set the highest next the Bowling-green, and so shorter and shorter till the lowest were next to the Garden; which I did for these Reasons: Next the Green was the worst Ground, and the Trees more in danger of being spoiled, by reason of a Market-path that goeth cross that end of the Walks to *Watford*.

Thus

Thus having set my Trees streight in their Rows, and trod the Earth close to their Roots, and made my Hills, I then laid round every Tree, upon those Hills, wet Litter taken off from the Dung-hill, a good Barrow-full to every Tree, and covered that with a little Mould, leaving them to take their rest for a time; but early in the Spring I found them to begin their Progress, and that Summer they had such Heads shot forth, that I was forced to cut off some of their Heads (that is, the side-boughs) to keep the Wind from breaking them: There is in these four rows of Trees 296. and of these I lost not one Tree the first Year, but they did grow and shoot so well, that there were several Noble Men that saw them, did think, as they said, that they were not removed the Year before; but the year after we had three spoyled by some base Men or Boys.

Of the very same parcel of Trees my Lord gave Sir *William Temple* thirty of the best of them, which he himself saw chosen out; they were Set at Sir *William's* House at *Sheen*, a much better Natur'd Ground than ours, yet they lost all but six of them the first Year: I saw a walk of Line-trees (but I think they were the Bastard-kind, which we have growing in many of our Woods in *England*) set at *Debden-ball*, the Right Worshipful Sir *Richard Brown's* House; the Natural ground was not bad for them, but how they were Ordered I do not know, for they had the first year not above one in ten that did grow any thing considerably.

I saw the like (or worse) spoyl of the same Trees at my Lord Chief Baron *Turnor's* near *Sturford*, where the ground might easily have been made very good for them. I only write this, to perswade Noble Men, and others that are Lovers of Planting, to remember the old saying, viz. *A thing once well done, is twice done*: And those that are resolved to Plant, that they make their Ground fit for those Trees before they set them, and not bury them in a hole like a dead dog, as too many do. Let me then beg that they may have good and fresh Lodgings futable to their Quality, and good attendance also, to preserve them from their Enemies, till they be able to encounter with them; they that will not do this. let them never resolve to Plant Trees; for why should they spoil the least of those stately Monuments, and in so doing throw away their Monies? For let such note that Nature bestows not her gifts but where she finds futable Convenience, therefore order your Ground well, and then you may see a good success, as my Lord hath had in several of his Plantations, though as bad ground as most is to Plant on. One Night (me thoughts) walking up one of my

my Lords Line-walks, I heard the grateful Trees thus Paying the Tribute of their thanks to his Lordship:

*Like Pyramids our Stately Tops wee'l Raife,
To Sing our Noble Benefactor's Fraife;
Freshly we will to After-ages show
What Noble Essex did on us bestow;
For we our very Being owe to him,
Or else we had long since intomb'd been
In Crop of Bird, or in Beasts Belly found,
Or met our Death neglected on the ground:
By him we cherish'd were with Dung and Spade,
For which wee'l Recompence him with our Shade;
And since his kindness saw us prun'd so well,
We will Requite him with our Fragrant smell;
In Winter (as in Gratitude is meet)
Wee'l strew our humble Leaves beneath his Feet.
Nay, in each Tree, Root, Trunck, Branch, all will be
Proud to Serve him and his Posterity.*

Thus having shewed you by Example the good Effects of a light Brick-Earth upon Gravel, I could also tell the same of a Fat Sand, drift-sand, small Gravel upon your Clay or stiff Ground; but I hope that I have informed your Judgment so much, that you will Reasonably conclude with me, that the preparing of Ground for Trees is, onely to mix Ground so together, that there may be convenient room for the Roots to search for their Nourishment; and to humour the Tree so, that there may be a good part of the Natural Ground which each Tree delights to grow in. I know that if your Ground be a stiff Clay, then to trench and mix it with fat Sand, drift-sand, Lime, Rubbish, or Chalk and Lime, are great helps to such Ground, either for Trees, or Corn, or Grasse; and more lasting than Dung, and for Forrest-Trees full as good as Dung: For it doth not onely give leave, and make way for the roots to run in the Earth, but takes away that over-moistness in the cold stiff Ground, which hinders Conception, by letting the water down into the Earth, and by keeping it from Cracking, and so Nourisheth the Spirit of the Earth, and also keeps it from spending it too hastily.

Horse-dung is the best to make your hot beds with, for such Plants as are commonly raised of them be Annual Plants, but it is too hasty for the Seeds of Trees, unless it be rotten, and well mixed with Natural Mould: It is best for your stiff cold Lands, and if you lay it upon
Plowed

Plowed Ground (which 'tis best for) then Plow it in as soon as you can, for if it lies there to dry, there will a great part of the Oily substance, which makes the fume for nourishment of Plants, be exhaled out by the Sun: Let no sort of dung lie long on the top of your Ground unplowed-in, but plow or dig it in as soon as you can; for by lying so, it doth not onely lose a great part of its goodness by the Sun (especially if it lies thin) but where your Dung-hill lies every shower will wash the strength of the dung into the Ground, so that if you take the dung off from that place as clean as you can, yet you shall have that place bear Ranker Corn than where you thought the dung had lain much thicker, if it lies long in a place. The Observation of this taught me many good Uses; as first, to lay dung about the Roots of Trees is much better than stones, as my Lord *Bacon* Advises in his Natural History; for this keeps moist the Ground better than they, and Rain washes the strength to the Roots, as is aforesaid: and if you dig in this when the strength is gone, and your Trees strong, it then prepares way for the Roots, and there is a great benefit to your Trees. Or if it is not digged-in, but lies on the top, and there turns to Earth, it then feeds the Roots on the top, and leads them upward.

And seeing where Dung lies, the Ground is so much improved by the washing-in of the strength of the Dung, it may well inform you that Dung steeped in Water is very good, especially if you use Dung, in Quantity according to the Nature of your Plants, and strength of your Ground; the weaker your Ground, make your Water the stronger. There is in some places in Farmers Yards a Water that washeth from their Dung-hills, a Load of which is not inferiour to a Load of Dung, yet by them totally Neglected; but of Waters I shall speak more in the next Chapter.

Thus having hinted of these two Useful and Common Dungs, Cow and Horse, in the Example of these Line-trees; onely Observe this, and then I shall proceed: Horse dung is best for Plants that are quick of Digestion and Growth, and for Trees or Plants that shoot much in a year; for it yields a great Fume, and such Plants can well dispose of it.

Cow-dung is a good Soyl for most Trees or Plants of hot Ground, and better for durable Plants than it is for Annuals: It is Excellent for many sorts of rare Flowers, if first it be thorow-rotten, and then dried and beaten to dust, and some fresh fine Earth then mixed well with it.

Deers-dung is much of the Nature of Cows, or Bullocks; but 'tis more proper for tender and smaller Plants.

Sheeps-

Sheeps-dung is also of the same Nature, but more agreeable to tender and small Seeds and Plants: By this our Yeomen and Farmers find good profit, by Folding their Sheep every Night on their own Lands; for there they find a far certain benefit on their Ground by the Dung and Urine which the Sheep make in one Night; though it is not long lasting, yet 'tis a sure help for the first Crop, and a good Addition to the second.

This may teach you that a thin sprinkling of dung is more sure most years for your Corn-Land than greater Quantities; and also that to break your dung small is best; for the smaller the better, especially if you have laid it on your Ground not long before you sow, especially for your Summer-crops, from this I do Advise my Ingenuous Countrymen of these few Rules which are spoken before:

To well Observe the Nature of your Land, and by so doing to enrich it with such Soyl and Dung as is most Natural to the Ground, and to the Seeds you intend to sow on it; and to lay it on your Ground at the most convenient times.

First, as to the Ground, I have hinted at many useful Composts, and also that several of them are far more proper for some Grounds than they are for others, though there be many more sorts that may be and are made use of to very good Effect, yet I shall not trouble myself nor you with the naming any more, knowing that he that Understands to Number to 20 in Arithmetick, may soon count to a 100.

Now, as to the Seed you intend to sow, whether it be of Trees, Plants, or any sort of Grain, the smaller your Seed is, make the ground the finer; the quicker your Seeds be of growth, and the more they run into stalks or leaves, your dung may then be the newer and stronger, and the more in Quantity, according to the Digestion of your Plants. But if for Trees or Plants of long lasting, then let the dung be the more rotten; and the more they be apt to shoot great shoots, the more you may allow them; but let them be sure of some such Ground as they Naturally delight to grow in, and also to allow them room that is large enough; for High and Lofty Spirits do not love to be Confined to little and small Cottages.

And as for laying it on your Ground, if the time be the Spring, that is most proper to sow your Seed, then lay such dung as is hot and dry early on your Ground; and rather erre in too little than too much, such dungs as be your Pigeons, Hens, Sea-coal-ashes, &c. But if they be hot and moist, such as Horse-dung, Horse-litter, or Green grass, Hay, &c. these be most proper for Annuals, and it is not good to be too sparing toward these tender Plants; rather erre in keeping your

dung too dry than too wet, for in so doing you shall keep its heat the longer, and have the more Command to keep it so: But if you have occasion to lay dung on Ground to help such Trees or Plants as are not Annual, but more slow in their progress, then mix such dung thin, and not too near the Roots; but if it be the Autumn Season that you have occasion to lay it on your Land, then lay it something thicker; for the Winter will qualifie the strength and heat of it.

To conclude; if you are to lay dung on Land that you are to sow with Seed that doth not run much into stalks, and is but slow in growing, then do as our Farmers do, let it be rotten and mixed well with Mould before you lay it on your Land, and then your Grain or Seed will the better agree with it, or else you may find on your Land strong great Weeds, such as the Ground is most inclined to; for strong Land will produce the stronger Weeds, and the other contrary.

Therefore if your Dung be too rank and new for the Seed you intend to Sow your Ground with, then mix it with some other Compost as is most proper for your Land, and most convenient to be had: and if your Land be stiff, then mix it with Chalk, Light Sandy Ground, or somewhat of the like Nature; laying a good quantity of Earth first, then your Dung, and then Earth to cover your Dung all over; by so doing you will save that Oily water which will soak from the Dung by showers of Rain into the Earth under the dung: and by covering your dung with Earth it will keep the Sun from drying out that moisture; and whatever Fumes arise, the Earth on the top will receive: be sure you let it not grow with Weeds on the top, but when you find them to appear, take them off, and suffer none to grow on your Compost; or turn it over, and mix it with your Earth below, however let it be mixed together before you lay it on your Land: Thus do with New Horse-dung and Litter, but if it be any other dung, lay it on your Land as soon as Opportunity serveth; for the longer you let it lie, the more it loseth of its strength, therefore lay it on rather too thin, and in dry weather, and early.

*To assist Nature do thou not neglect;
Use her not Roughly, lest there be defect.*

Thus much may serve for Trees, but if it be for Flowers, or other fine and tender Plants, you then must be more Curious, and mix your Earth better; but they be out of my Road at this time. The main business is to prepare your Ground so, that there may be room for the roots to run in, to fetch their Nourishment. As for Trees and Plants that

that root deep, trench your Ground accordingly, &c. Now, for to please the Tree or Plant with such Earth as it delights to be in, add such a quantity of dung as may be futable to the growth of your Tree or Plant, thereby to make a fume to feed it; for let this fume be made of what it will, for my part, I shall not contend whether it be Salt, Sulphur, or Mercury; or as some affirm, that 'tis Salt, Sulphur, Mercury, and Spirit: All, or any one of these that feeds the Plants of this Terrestrial Globe; or if it be Fire, Earth, Water, or Air, as was formerly the Opinion of the Learned; for Sulphur or Brimstone may answer to Fire, Salt to the Earth, Mercury to Water, Spirit to Air.

For 'tis certain, that Plants have Salt, Sulphur, Mercury, and Spirit in them; some more than others, according to their Heat or Coldness, but that they feed on these is not certain to me: But it is as I conceive the Fume, Steam, or more properly the Spirit of the Earth that they feed on; for the Earth is full of Spirit, which is the cause of the vast many productions of Plants, and Insects which are produced every year, and from no seed or sperm, but according to the fit Matrix of the Earth; and the Star fire, and Virgin Mercury: their Dame Nature is then busie to make some Plant or Insect according as she hath provided a Breast to suckle and feed them.

The Earth is then but onely a Lodging-place, and simple Water is onely its Garment; for simple crude Water feeds nothing, but is rather Destructive, as is seen by Water that runs forth on a Gravel, and the stream quick, there is seldome good Meadows by such Rivers, unless there be some Town that washeth it self into the River, or good Rich Land, or Lanes, or the like. Your Spring-water, unless it have some assistance, is the like; but of Water, see more in the next Chapter.

And now I shall give you an Example of Earth, by which you may well perceive that Plants do not feed on simple Earth, nor crude Water. My Lord was the Author that told me this, and as soon as the Season of the year did permit me, I then did try the Experiment, which was thus performed. I took out of a Hill of good Rich fresh Earth (which I had prepared for other things) some of the dryest, somewhat above a good large Flower-pot full; this I carried into a little Room, which I had at *Hadham-Hall*, it joyned upon the Bake-house; there I spread this Earth thin upon the shelves, now and then turning it till it was as dry as dust, and as I thought, as dry as it well could be, provided it were not burned: having thus prepared my Earth, I filled a Flower-pot with it, which pot and Earth thus filled, weighed as exactly as I could weigh it just eighteen pounds and a half.

March approaching, in the year 1666, I put this pot into a hot bed, to secure the seeds, and withall to help forward my design to preserve them: the seeds were Purslain which I sowed in it, the quantity was very small: I kept this pot in hot Beds till the beginning of *May*, and then I set it under a South Wall, where it stood till that Moneth was out, and then I set it in the shade from the Meridian Sun: there it stood till the latter end of *August*, and then finding my Plants full of seed and at a stand, I then cut up the Purslain close to the ground, at Noon-time, when it was very dry, and weighed the Purslain as exactly as I could, and it weighed just six pound two ounces. Then I took the pot of Earth and set it in a South Window in a Banqueting House to dry, turning the Earth to the Sun, to dry out some of the moisture, for the Earth was wet, for I had kept this pot with watering all the Summer, as occasion served: then I took this pot of Earth, and carried it into the little Room to dry the Earth as I did before, and putting some of the Earth into a Box, and the rest in the pot, I made it as dry as it well could be, or at least as dry as it was when I sowed my seeds in it: and then putting all my Earth into the pot again, I weighed it as exactly as I had done before, and then the pot and the Earth weighed just eighteen pound and seven ounces; there was, I confess, the roots of the Purslain, but when they were dried, I do believe they did not weigh one ounce; and this one ounce that it lost of weight might be Earth dashed over with Rains.

Now, these Plants weighing so much, and the Earth wasted or decreased in its weight so little, doth plainly shew that Plants do not feed onely on Earth; for I do believe this, that the earth that was wasted, was dashed out of the pot by hasty watering, and by sudden showers of Rain, or perchance some might go out of the holes of the pot with the Water.

Now, though Plants do not feed on earth, yet Earth is the Nurse and receptacle of most things, and the Earth is spongy and porous, fit to receive the several Influences of the Heavens, of Heat, Rains, and Dews; and stores them up for the Conservation of her products: and when the seed or plant desire it, is put into Motion by the Cœlestial heat the earth freely gives out of her store, according as the Plant can dispose of it.

And if there be no Plants to feed on this Spirit of the Earth, then many times Nature makes some which do; for the earth will produce several Plants of its self, without seed or root, but they be Plants of no long lasting, and when they die, they then turn to Air and Spirit, as all things do; for there is nothing that is at a certain stay, for all things have

have their time of increasing, and their time of decaying, till they be turned to that of which they were made.

No man can see Trees grow, yet all men know that they doe: It is plain to see when a Tree is decaying, yet to know how long it will be before it is of its own decaying turned to Earth or Dust, is hard to know: Though it is Reported, that an Oak is a hundred years a growing, a hundred years stands at a stay, and a hundred years decaying, yet this is very erroneous; for on shallow Grounds an Oak will not grow so long, and on deep ground much longer, and neither it nor any thing else stands at a stay, but when it doth begin to decay, it keeps on, according as it meets with Accidents, till it comes to dust.

*Thus have I ghes's'd, but whether right or no,
The Criticks lash I'm sure to undergoe.
I to th' ingenious Practiser direct
These lines, which hope with him to gain Respect;
For Learned men oft-times mistaken are,
When Foo's as oft ghesse right, though unaware.*

CHAP. IX.

Of Water for Trees and Seeds, and watering them.

I Have oft observed your Cisterns and other places, that are onely filled with Rain-water, that that water will in a Summers time produce several sorts of Insects, and some sort of Water-plants; and also that it will leave a green slime not much unlike to Plants, which substance (or slime as I tearm it) would certainly be spent into Plants, were there but some quantity of Aquatick Plants put into this water; such as Mints of any sort, yellow Water-flagge, Flower-de-luce, Crabs-claws, or water Sen-green, Brook-lime, Ducks-meat, &c.

I once made an Experiment to trye this, which I have here inserted, and thus it was: I took two water-pots, and filled them full of water, out of a Fountain which had been filled by Snow and Rain the Winter before, and which was made clean the *Michaelmas* before: I set these two pots, thus filled, in the open Air, but in the shade, and put into one of them a good handfull of Mints, the Runners, which I put
in

in the first of *March*, 1664. where I let them continue till the first of *April* next, and then put in a fresh handfull, and let that continue for one Moneth more, and so I did both *May* and *June*: I poured out this Water about the beginning of *September*, to observe which of those Pots had the most of this slime: whereupon I found, that pot that had no Mints put into it, had twice as much, and being forced too to fill up that pot that had the Mints with the same water often, and that pot that had no Herbs in it, the slime of it was green; the other pots settlement that was in it, was black, and of an Earthy colour: I did intend to have prosecuted this further, as to have filled two pots of fresh Earth, and not too rich, and to have sown in them several Seeds, and to have kept them from all water but this, and then to have noted well the success, with more like Fancies which I thought on; but I was prohibited by one of the Drones of this Age, and did not know whether I should stay or not.

A Stone lying in water gets a kind of slime about it; and if you put into water seeds that be quick of growth, (as most of your *Annua's* are) keep it but temperately hot, and they will in a little time spear out, and then if you put them into fine Mould, temperately moist and warm, you may (if you pull up one of them and observe) see the Roots feeding upon a white substance, which I have often observed; for in water is the seed of all things. Likewise put seed into Earth, and if it be very dry, then though it be kept never so temperately hot, it will rather keep the seeds from growing than hasten them.

But water dissolves, then Life followeth the dissolution; for water opens the parts of the Seed, and makes them swell, then they draw the Spirit of the water to them, (for the World is full of Spirit) so the Seeds they have been so long in water till the body of them cracks, which is as soon as it hath filled it self with enough to make a Root, then that seed if once dried, and a stop put to its proceedings, the Art of Man cannot make it grow again. I have heard some affirm, that Malt will grow, but 'tis false, unless they mean some Barley-corns which never speared.

Therefore if you have once watered Seed, keep them with watering if the Earth require; and if your Earth be poor, and your seeds great growers, then water with rich dunged water, and often, but let it not touch the Leaves; and if you think your ground be too Rich for the Nature of your seed, then water your seed with water not very Rich; but if your seeds be slow-growers, for such keep your ground only moist, and no more; for, though it be Earth that stores up the Spirit that feeds Plants, yet it is water that sets it on motion, and water

is full of Spirit also, but without Heat both these lie still: for Heat draws out first the crude water, and sends it into the Aire: Therefore, unless it be for Aquatick Plants, or Plants that grow much, and the weather be warm and drying, do not water too much, keep your Earth just moist; for when ground is full of water, the Coelestial Fire heats first the *superficies* of the Earth, and puts that into a fume, but the Roots which are deeper in the ground being covered with water, there is no fume riseth there till most of the water be drawn up by the Sun, or settled into the Earth: Therefore if your Ground be subject to be wet, keep it loose and open, by deep trenching, and Earth to drein away water; for it is oft seen, that good Land that lies low in a wet Spring hath no great burden, because it is over-pressed with wet; and dunged Land in a wet year bears the worst Corn, especially if it be low stiffe Land; for Dung then holdeth the Moisture, and the ground being wet withall, commonly doth produce great weeds, which can digest the spirit of the Earth and Water better than Corn, because they grow much quicker, and so they spoyle the Corn: For the greatest good that Dung doth to Land, is, to hold the water in the ground, and to keep the ground hollow, for the Roots to fetch their Nourishment. For 'tis the nature of Dung to draw water to it, to fill it self like a Sponge; and when dry weather comes, then it spends it self in fume, and so it wastes it self, and feeds Plants by its decay. Thus you may see and admire the Order of the great God of Nature; that the Destruction of one should be the Preservation of another.

This you may observe in rotten Wood, Malt-dust, Wool, woollen Rags, Horn-shavings, &c. how full they will be with every little Dew, and keep that longer than a Clod of Earth twice as big, thus will they doe till they be turn'd to a very little Earth: By this you may inform your self what sort of Dung will last longest.

Some sorts of Dung there be, that if they be not over-pressed with Water, will waste themselves by their own heat; Witness your Hot-beds, &c. yet notwithstanding, this heat is very Natural to Annual Plants.

Dung steeped in Water, or water strained thorow Dung, doth take a great part of the substance and strength of the Dung with it, and that water when dried up in the ground, and evaporated, when Rain or Dew falls on that place, it there leaveth such an Oily or slimy substance as catcheth the Water or Dew, and hindereth it from running deep into the Earth, and then the Over-plus which the Plants receive not, is rarified into Air, till it hath spent it self as it were to nothing.

After

After dry weather in Summer, if there comes a good shower, and a warm day after, you may see this Fume hang in the Aire, sometimes low, close to the ground, as if it were loth to part with the Earth, and toward the latter end of Summer, if great Rain and warm VVeather happen, then this Fume being great, and the Nights something cold, it will spend it self in Mushromes, Puffes, &c. as old Trees and rotten VVood will doe, where there is a great decay, and nothing to feed on.

Therefore, if you fear dry VVeather, do not deferre too long before you water your Trees and Seeds, but water while your ground is yet moyst: for believe me, I would not have you stay too long before you water, if you be minded to water at all: And also when you do water, do it well; Consider the depth of your Roots, and those that root deepest, water most; and also when you begin to water, continue it as long as you find occasion: water Trees well, and Seeds and small Plants often: use not VVell-water, especially for tender Plants, for it is so strained thorow the Earth that it hath little spirit to mak Nourishment in it for Plants. Rivers that run quick and long on sharp gravel are little better; therefore if you must use such, let them stand some time in the Sun, in Tubs, &c. mixed with Dung.

Let the Quantity and Quality of your Dung be according to the Nature of your Plants; as, if your Plants be great growers, and require heat, then put Horse-dung, &c. in the water.

If your Plants be fine and tender, then put Sheeps Dung, or Cows-dung, &c. into the water, remembring, that if you think your ground be bad, you must adde the more Dung.

If your VVater be bad (as is aforesaid) and that you put Dung into it to help it, let it then stand in the Sun and open Aire uncovered.

Take care you water no Plants with standing stinking Ditch water, nor no water that stinketh: for sweet water not too clear, and fresh Mould, not musty or tainted by stinking weeds, &c. is as proper for tender Plants, as sweet and good Food, and warm and clean Lodging is to a tender fine-bred man.

Rain-water I take to be very good, if not too long kept; yet if your Vessel be large, the oftner you stirre it, the longer it will keep sweet.

Large and Navigable Rivers, (such as our *Thames*) that receive much Soyl by the washing of Streets, and the many Sinks that run into it, and which by its own motion doth cleanse it self from that which is noxious both to Man and Plants; is a most excellent Water for all sorts of Plants.

The larger that Ponds be, the better their water is for Plants; and if they have the shoot of some Stable-yard into them, it adds much to their goodness; the opener they be to the Sun, the better; and the more of motion they have, as by Horses washing in them, or Geese or Ducks swimming in them, 'tis so much the better: for the swimming of Ducks in Summer in your small Ponds will keep the Water from smelling.

Now having shewed you several wayes of raising Forrest-trees, with some other hints of their Seed, &c. and of Compost for them, and of VVater, and VVatering them, I now shall shew you the manner how to raise them of Seed, which is to be preferred before all others, though some of the aforesaid wayes for some Trees are much easier and quicker.

Good Aire for Plants (as well as Men) is much assisting to their Health and Life, for without this nothing can live; and that which is most healthfull for tender Men, is also the best for tender Plants. Aire takes up the earthy Exhalations of all sorts, and there mingles them together, and being touched with Cœlestial Fire, it reduceth them into general Principles, for great uses. I shall say no more of Aire, for it is an Hermaphrodite, and is inclosed in Water, therefore near a-kin to it.

CHAP. X.

Of the Oaks Raising and Improving.

I Shall not trouble you with the several kinds there be; though the Learned *J. Evelyn*, Esq; Reduceth them to four, in his Discourse of Forest-Trees, but if they were distinguished by several Names, as we do our Pears, you might find as many varieties, onely according to the shape and taste of the Acorn: for as we know by Experience that several of our Pear-Trees grow Pyramid-like, as the Oak-man-berry, and Bordon-Musk-Pears, &c. And some likewise grow much spreading, as the Winter-Bonchristian, the back Pear of *Worcester*, &c. Even so do some of your Oaks; therefore if you desire aspiring Trees, take care to gather your Acorns off from such Trees, or rather gather them from under some such Trees, when fallen, and in a dry time if you can.

When you have so done, lay your Acorns thin in some open Room to dry, and when they be dry, keep them in some dry place till the latter end of *January*, and having prepared some good fresh Loomy Ground, by digging and keeping it clean before-hand, sow them, and let them be covered about an Inch and a half, or two Inches deep; by sowing them at this time, you shall save a great many, which otherwise would have been spoyled by Mice or other Vermin; but if it happen to be a wet time when they fall, then will they begin to spear out in a short time after: And then so soon as you see them shoot forth a little bud at the small ends, commit them to their Spouse as soon as may be; for when they be come to the time that the Almighty hath allotted them, and be fed and made lusty by the dews and showers of the Heavens, then the Star-fire impregnats the Moisture in the seed, and then the seed throws off, or endeavours to do it, and then takes his Lodging in the Earth, where he prepares a room for his Off-spring; that is, as soon as the seed hath imbibed himself in the Water, and received heat, (for without both these no seeds can produce its kinds) the Body of the Acorn cracks, and the spear shoots into the Earth, and as soon as it hath got Entertainment there, and the Season of the year agreeable, the Body of the seed either turns into leaves, or spends it self into leaves, and that little small part of the seed, the spear, that shoots forth Root, and
the

then shot and leaves ; so that if the Acorn hath had a convenient quantity of heat and moisture (but if too much of either of these, that is deadly to all seeds) then the seed spears forth, and if it be not committed to the Ground before it be dried, and the spear withered, then for certain that Seed, Acorn, Nut, or Stone will never grow. For Nature, if once set on Motion, will rather cease to be, than alter its course ; for Nature hates violence, neither can the seed receive this precious sperm without these two, Father and Mother ; and these two must have a sutable Agreement between them : for though one Vessel be sufficient to perfect the Infant in the Womb, yet Nature hath not been wanting to provide several Breasts to Nourish it. Therefore if your Acorns have taken wet, and the heat hath made them spear, you must sow them as soon as you can, and venture them a whole Winter in the Ground ; remembering to keep some Traps set to catch the Mice.

In the Spring following they will come up, keep them clean from Weeds, and let them stand two or three years on their first bed ; then having prepared a piece of good fresh Ground, by adding some rotten dung to it, if poor ; or good fresh Rich Ground (which is better than dung) cut the tap-root, and the side-boughs, and set them as you do other Trees in your Nurseries, keep your Ground with digging, and the Trees with pruning up every year ; thus Order them till you find them fit to Remove, and you will then find no such hazard in the Removing them, as if they were never Transplanted before ; for there is a great deal of Reason to be given that the sfter you Remove a Tree, the likelier 'tis to grow when it is Removed again, provided it be not too great. Besides, Experience doth plainly shew the same, for I have often found that a Walnut-Tree set of a Nut, and never removed in its Minority, but still keeping his place of Situation till it is six or seven Foot high, that in Removing such a Tree, you shall find near as much hazard in the growing of that Tree, as in Removing an Oak of the same stature, provided the Oak hath had his Abode in open Air, and not been tenderly Nursed up in a Wood ; for such Trees, let them be of what kind you will, are nice to be removed out of their warm Habitation : But at this I have hinted before. Now, to shew you some Reason why any Tree being Removed before, is the likelier to grow when removed again, Observe these few Rules :

First, 'Tis the Nature of all Trees to put forth one Root first, and then some side-roots, according to the Kind and Nature of the Ground ; and this most stately Tree doth commonly run to the bottom of the Soyl that is fit for his Nourishment, before it puts forth many side-roots, especially in a loose, hollow Ground, and then at the end of the tap-root

it puts forth feeding Roots, and when this Tree comes to be pretty big, it having few feeding Roots near home, the Tree can hardly be taken up well, without losing most of them, which will be a great hazard to the loss of your Tree.

Secondly, But when a Tree is taken up young, as at one, two, or three years old, then there is but small head, so that a little Root will maintain that and then this little Root lying not deep, and in a little compass of Ground, may be taken up with less loss, to the proportion of the Head, than a greater.

Thirdly, When you have taken up these young Trees, in cutting off the end of the tap-root, and the end of the greatest of the others, those very ends so cut off with the slope lowermost, will at that place put forth many small Roots, which lying near to the Body of the Tree, are the easier to be taken up with the Tree when 'tis Removed again.

Lastly, Custom in Removing of Trees tends somewhat to their growing; being Removed; for I fantasie, that if you could get some Acorns of an Oak, that had (with his Fore Fathers) been accustomed to Removing, as our Apple-stocks are, I do Judge it would be then as patient of changing his Habitation as they. From that which hath been said I hope you will conclude with me, that 'tis best to Remove, either Forest-Trees, or others, when young; for if you Remove them when they be older, the better the Ground is, the more the Tree runs down with a tap-root; therefore if never Removed before, the worse to remove off from such a Ground.

Thus having Ordered these Young Trees till you have Nursed them up to the stature of six or seven Foot high, you may afterwards Transplant them into your Walks, Wood, or where else your Fancy pleaseth, only in Transplanting Observe this:

Make your holes four Foot wide, and two Spade deep at least; half a year, or a quarter at least before the time of Planting (if it be a year 'tis the better, provided you keep that Mould which you threw out of the holes clean from Weeds and Grasse, by turning it over as Occasion requires) and if you think your Ground be poor, or of some contrary Soil to what your Tree Naturally delights to grow in, mix it with some such like Earth as your Tree doth best delight to grow in; as for an Oak, if your Ground be Gravelly, mix it then with the upper Spade of Ground that is a Brick-Earth, turning these together with the Earth you did throw out of the holes; if Clay, mix it then with a light Loom, or a fat Sand, or small Gravel; and if the Ground be poor, a little laying of rotten dung in the bottom of your holes, but let none be among

among your Earth when you set your Trees, that is, to touch the roots of them.

Having thus prepared your holes for your Tree, and your Earth, if your Ground be a dry Soyl, then begin as soon as you find the Leaf to fall, that is in *October*: 'Tis not the Hill or Valley, North or South Situation which makes the finer or tougher Grain; but if there be a feeding Ground on the top of an Hill, or on the North side, more than there is in the Valley or South-side, there then will be the toughest Timber; for where a Tree grows most in a year, that Oak is the toughest Timber, and there that Tree shall have the most sap, as on a deep Loomy Ground: But let it be Hill or Valley, if it be a shallow ground, and the bottom Gravel, and not mixed with Loom or Clay, there Oaks will grow slow, and the Annual Circles being close together, the Timber must then be the finer Grained: and the sap of such Oaks is little, as I have many times Observed: Experience and Reason (which I have alwayes hitherto taken with me as Guides in my Travel and Search after Nature) have confirmed me in this: A light Brick-Earth, or a Loomy-Clay produce the stateliest Oaks, soonest, and toughest Timber, for there they grow quickest,

Your Clays produce great Oaks, for that is a holding Ground; although they grow sometimes slow, yet they last long.

Your Gravel produceth many Oaks, and streight, they grow slow, the Timber is fine, and they decay while they be young; the Reasons of this I have told you before.

Having made Ready your Holes, and taken up your Trees well, I Advise you to open the Earth well round your Tree, keeping the side of your Spade to the Body of your Tree, to prevent Cutting the Roots when you take them up; and also to digg deep round the Tree, that when you come to pull up your Tree, it may come up easily, which will prevent those Roots, which grow Elbow-like, which if they do not break off in pulling up, by straining them to pull up, they will crack so in the Elbow, that they will never grow, nor put forth Roots below that place; therefore for such Trees as be ticklish to Remove, take the more time, lest you verifie the Old Proverb, which saith,

*Too much haste
Of makes waste.*

Such Roots as you find Bruised, or much Cracked, cut them off, till you come at firm sound Root. Such Trees as are slow-growers, as the Oak is, you may prune up to the smaller Head; as, if your
Tree

Tree be taper and streight, you may prune up such a Tree to one shoot; but if your Tree be not taper, then leave two side-boughs, or more, to receive some of the Sap, which will make the shoot that you intend shall lead to make the body of the Tree, the smaller, and so your Tree will be taper; but top your shoots, all but your leading shoot, which will make the Body of your Tree swell the more, and hinder them from equalling the leading-shoot, and by topping the other it will grow the stronger: I need not tell you which shoot you should leave to be the leading-shoot for your Tree, not Questioning but Sence and Reason will teach you to leave that which grows streightest and strongest; if you do leave any shoots, as most often it is necessary, leave them not right against one another, for that will make the Tree grow too suddenly thick in that place, but leave them one above another, so will your Tree grow the more taper, for it will be less and less upward, between the shoots, which shoots you must take off Year after Year, as your Tree runs up in height, minding still, now and then to leave some side-boughs to keep the Tree taper, or else you will want your height of Timber; or your Tree may grow top heavy, and so Crooked: I speak of Timber-trees, or the ways to Order Trees for Timber, (for I wish all Oaks were fit for Timber) but if your leading-shoot be much Crooked, then top it underneath a bud that tends upward, so low as if that bud lead away, it may grow near streight up; or cut off the leading-shoot under another that grows more upright, Ordering it to be the leading-shoot; so, as your Tree grows, mind to lead it up every Year, according as you see Cause, taking care to keep off the Suckers, especially the first Year, unless you find the Head grow too great for the Body, then leave some side boughs to receive some Sap, and to make your Tree taper, but this you shall hardly find in Oaks in their first Years growth, namely, to grow too much in Head.

Thus endeavouring to keep your Tree, (of what sort soever it be, if it be for Timber) with no great Head, still keep the leading-shoot uppermost, by sometimes heading the other side-boughs, about a Foot or more from the Body, or else they will be ready sometimes to make your Tree top-heavy, therefore keep your Tree till you have got it to the height you intend, by keeping it as is above-said; and if you find it is not taper by these means, then in the Moneth *February* slit the Bark quite thorow on three or four sides, according to the bigness of your Tree; but if small, but one or two: so if the Tree be three yards high to the Head, then let three slits go up one yard, two slits two yards high, and one to the top: But if it be a streight Tree, and taper, as you would

would have it, if the Bark be bound, slit it on one or two sides, from the Ground to the top.

If your tree be young, though thriving, it will do it no harm, but much good, for you may see in many thriving trees the Bark part of it self, telling you that it wants your help, therefore observe Nature, and assist her in all your undertakings; for Wisdom standeth, not onely in the Streets, but in the Woods, calling to you to learn of her.

Note also, if you find any tree Crooked, slit it in the ham at the afore-said time, and take off some of the lower side of his Head, and you will help the crook of the tree, whether it be great or small; and in time, by so doing, it will grow streight: for by slitting the Bark in the ham it makes the tree swell there, and so sets the tree streight; therefore make two or three slits in the ham, according to the bigness of the tree and crook; but if the tree be pretty great, then take your Bill and cut the Bark thorow in the ham in several places, about two or three Inches asunder, let the Cut be cut slanting upward, a little crosse the Diameter of the tree; by so doing you will stop the Sap in that place, the Bark will dilate, and the place grow greater, and so the tree will grow streighter.

Sometimes if your tree be not taper, in Summer when it shoots much, the weight of the Head will draw the Body crooked, and the Head will incline to the Ground; in such trees Leave shoots on the Body, to check and receive the Sap, and to keep it from abounding too much in the Head; but when you find your tree grown crooked by the Head, in Summer, with Leaves and Boughs weighing it down, as soon as you find it begin to leane, take off some of the Boughs on the leaning side, and top some according as you see cause: By this Summer-pruning you may keep your tree streight, therefore Observe it. I have found good success on Walnut-trees and Lines by it, &c.

But though Oaks grow Crooked, it is not often by their great shoots, for on most Grounds it grows slowly, but sometimes their Head, or leading shoot being cropped off by Cattel, it then breaks out on the sides into several leading shoots, and one leads one way, and another another; and so distributeth the Sap, which makes the tree not onely grow crooked, but slowly; and sometimes the early shooting of the leading-shoot in the Spring causeth the same: For Frost coming upon the tender leaves and leading-bud, kills them, and then it is forc'd to break out a new on the sides; this happens often-times to young seedling Oaks in long Grass, which would gladly be more in the open Air, but by making too much haste many times they lose their Heads for it. Now in such Cases you must take off some, and cut some half a Foot off from the leading-shoot,

pre-

preserving that which is most likeliest for the leading shoot, which though it be crooked, despair not, for Naturally it will grow streighter, and if you use pruning, and the afore-said Rules, it will be straight much the sooner. But in case you find your Young Oak very much stubbed near the Ground, and never a shoot that is fit to lead to make a Tree, in such a young Tree you must cut it off close at the Ground, in the Spring-time, so shall you have one fine shoot or more, but be sure take off all but one, and then you shall find that shoot thrive very much, till it hath got such a Head in bigness as the Head was before, and the Bark being then fine, it will enlarge it self for the growth of the shoot, and give good way for the Sap to run into the Head, and so make a fine Tree; therefore if your Tree be stunned, or much Crooked, then take this course, to head them close at the ground, and the Summer following neglect not to take off all the shoots but one, for at Midsummer it is as good, nay, better to prune some Trees than in the Spring, for then the Sap will soon cover round that wounded place, and if not heal it quite, it will preserve it from much harm, till the Spring following, and at that time shoots will not break out much into the head, to make it top-heavy: You may safely cut off small branches, and prune small Trees at this summer-season. And for such Trees as have a great Pith, as the Ash and Walnut, I take it to be the best time for them. And whereas some say to the contrary, yet if the Reader will be Advised by me, let him prune such in Summer. But in the midst of Winter forbear to prune most Trees, especially great Boughs, or such Trees as have a great Pith, ortender, for then the wound lyeth exposed to the open Air and Wet, and Frost coming upon the Wet, and piercing so far into the wounded place as the wet hath gone, kills the Wood, and makes a hole in that place, and that hole holding Water many times, Kills many a good Tree, especially where great Boughs are taken off, for they be long a covering over; and never will be covered if the Tree be Old.

Therefore if your Tree be Old, forbear to cut off great Boughs; but if for some Reasons you are forced to do it, then cut off such Boughs two Foot, or a Yard from the Body of your Timber-tree; and let the place where you cut off such a Limb be perpendicular to the Horizon, rather inclining to the *Nadir*, than the *Zenith*; by so doing, the water will not lie on such a place, and then the Tree will receive no harm.

But if your Tree be young and thriving, then cut off the Boughs as close as you can, keeping the wounded place perpendicular to the Horizon, and be sure not to leave Elbows to receive the wet, as too many of our Husband-men do; for, the closer you cut off a Bough to the Body,

Body, the sooner the bark covereth that place, therefore cut off the side-boughs of young Timber-trees close and smooth.

I wish I could perswade all Lovers of handsome Timber-trees, at every Fall of their Woods to prune up all the Timber-trees; but then the Wood must not stand too long before it be fell'd. You may prune off boughs of ten years growth very well, and so every ten years, or oftner if it be in Hedg-rows, prune up your Trees till you have got them to such a height as you find most convenient, viz. to fifty or sixty foot high: For I have many times observed Trees, of Oak, Ash, Elm and Beech, to have leading shoots sixty foot high and more, when they have had not above ten foot of good Timber; for Boughs have broke out at that height, and have so distributed the sap, that they were little worth, but for the Fire; when, if they had been pruned up as is before directed, you might have had the same height of good Timber; which, how much more profitable it would be, and also beautifull, I leave to any mans Judgement.

The Ash and Beech cover the wounded place over soon, and seldom break out many side-boughs: The Elm very frequently breaks out side-boughs, yet will arrive to a great height of good Timber: the Oak is a little subject to break out side-boughs, and though a slow grower, yet by its own hardness of his Wood he preserves himself well till it hath over-grown the wounded place, which it will in a few years doe, if your Tree be young and thriving, and the boughs, not very great; for if the boughs be great, that place when they be cut off is such a Damm to the sap, that it forceth it to break out with many small boughs there; especially in such Trees as have a thick and rugged bark, as the Elm and Oak have when old.

But if the Tree be young and thriving, then is the Bark thin and loose, and will more readily give way to the sap to ascend into the Head, and not break out into side-boughs; but if some few do break out, often pruning them close off will prevent that: But if you would be at a little more trouble, note this which I have found to be true, and your Timber shall pay you well for your pains.

At *Midsummer*, after you have pruned up your Trees, take off all the small shoots that are broke out on the side of your Trees, close to the body of the Tree; do thus two or three years together, and you will find every year the side-boughs to be fewer and fewer, till you have a clear body, beautifull to behold, and profitable for as good Timber, thirty or forty foot or more, which otherwile would not have been a quarter so high. Thus may you make an Eln (which is a Tree most

subject to break out side-boughs) as clear from boughs forty or fifty foot high, as they be.

Your Oak that is young you may easily master, and bring it to a clear body; though it is somewhat troublesome in Woods, yet in Hedge-Rowes it may be practised with ease, or in Walks, or on single Oaks: But our Yeomen and Farmers are too much subject to spoyle such Trees as would make our best Oaks, by heading them, and making them Pollards. I wish there were as strict a Law as could be made, to punish those that do presume to head an Oak, the King of Woods, though it be on their own Land.

By this means we should have the Farmer that is scant in Wood, by often pruning off the side-boughs make many finer Trees than now there are; for in such places there is great food to make him a great Tree; and then in Coppices, if you let a Tree stand to be very great, it spoyle many a young one, and also your under-wood.

But methinks I hear some opposing me, saying, that by so pruning up of Trees, they do not prove so well for the Joyner, Carpenter, Wheeler, &c. for they say, if the Tree doth over-grow the Knot, when they come to cleave such a Tree, that place proves faulty within, and the Timber is not so good.

Secondly, They say, that cutting off the side-boughs, makes Trees more knotty.

Thirdly, they say, that it makes a Tree decay sooner.

To these three Objections I shall answer, and then hasten to conclude, and so leave my beloved Oak.

I do grant, that if the Knots be great, though the Trees be young and thriving, and have covered the place over well, if you come to saw out such Trees for Plank, Board, or VVainscot, that there may be some Defect there where great boughs were cut off; but suppose there be, you have still the same length clear Timber at the lower end as you would have had if these boughs had not been cut off; and then by pruning up your Trees, they grow straighter, and your Tree carries a greater length of Timber, usefull for Beams, Summers, Raifing, VVall-plats, Rafters, Joyce, &c. and how much Timber these spend more than the other, viz. Board and VVainscot, &c. I leave you to determine. But my Advice is, not to let your boughs be great, but take them off from such Trees whilest young, and then the boughs will be young and small, and such Trees will cover such places in a little time, and these small Knots will not be perceived then, in case the Tree be sawn for VVainscot, &c.

Again,

Again, as to the first Objection, this seems to me a full Answer; as first, for such Trees as stand abroad single, you shall find them to have a clear body, of six, seven, eight or ten foot high, I only ask my Opponent, whether such a length of Timber had Knots on it or no? I hope they will grant it had; well then, how comes it to be so clear without Knots? Now I tell you, 'tis Cattle that crop off the boughs whilst they be young, and that makes it clear from boughs, and the sap mounts up higher, and there breaks out, which if it were but taken off as it is below, it then would be as clear sixty foot as it is at six, and as straight.

This very Reason possess'd me so much, that it told me, an Elm (which is the most subject of any Tree to break out side-boughs) might be made clear Timber sixty foot high, as well as ordinarily they be six, by early, often, and Summer-pruning. This my Experience hath proved true.

Again, a Thorn or VWhite-bush growing in a Park, and kept under by Dear cropping of it, for eight, ten or more years, so that it hath got a hundred little boughs, if it once get but a leading shoot, and that out of the Dears reach, all shall unite in that one, and that shall come to be a straight body, and straight-grained, notwithstanding it was so crooked below; for the lower ones will all die by the Dear cropping them, and the saps free ascending into the leading shoot.

But as to the second Objection, I grant, that sometimes cutting off boughs, (especially great ones, and of Old trees) makes more, but then they be small; for the more a River is divided into small Rivulets, the easier those little ones are stopped and brought into one; for a great River must have a great Damme, and taking off a great bough is a great Damme to the sap; for the Tree falling suddenly narrow upwards, and the sap being used to spend it self there, and having free passage thither, when it is got into that place it breaks out on each side of the Knot, into many little boughs; but if you take off these little boughs that *Midsummer*, the Summer after there will be but a small quantity in comparison of the Spring-sap: And the bark being then loose, it makes the easier way for the Sap to ascend into the head, and not to break out into Boughs; and so having prepared the way by the Sap, that *Midsummer*-shoot will not be at a stand so much the Spring following.

Or if the Spring after you have taken off the Boughs, you take off the little ones that were shot out the year before, and slit the bark above each Knot, that is, somewhat great down to the Knot; by so doing you may bring your Tree to have a clear Body, by a few years

pruning; for I have Observed it usual in many Trees the Year they have been pruned up, for the Bark to have cracked an Inch or more; which tells you most plainly, that the pruning of Trees doth make them swell in Body, therefore help the pent places by sitting the Bark: you may often see this on your Ash, &c.

Pray you, how comes it, that in your Coppices you shall have Timber-trees ten or twelve Foot high, clear, without Bough, and then the Tree break out all into head? It is (I am confident) the under-wood which smothers, and beats off the side-boughs as high as that grows, and so makes the Timber clear so high: also if you mark where high Timber-trees are, that have clear Bodies a great height, they do, or did stand thick together, and so one draws up another, smothering the side-boughs, and beating them off (sometimes) by their Motion in great Winds.

Thus by what has been said of Cattels Cropping, Trees standing in Coppices, and by Trees standing thick together, you may Learn that you may do the same, and have Timber, by pruning, as clear from Knots, as it is by those Accidents.

Thirdly, Whereas they say it makes a tree decay sooner; I grant this, that to prune off great Boughs from an Old tree, makes it decay sooner; for the Wounded place being great, and the Tree slow of growth, is a long time covering over that place (if it can be done at last) and that takes wet and Air, and decays the Tree; therefore I do not Advise you to take great Boughs off from any tree.

But small Boughs cut off smooth, and close, from an Old tree or Young, causeth the tree to last longer, and to be clearer Timber: For when small Boughs are taken off from the side of your Tree, though Old, the Tree then not drawing much Sap, that little Sap doth most of it then ascend into the Head, and so makes the Head continue fresh and thriving the longer; and taking off the side-boughs makes the Tree to swell, and grow sooner into a great Body.

For the Boughs that break out of the side have not such deep Root in the Body of the Tree, (I mean those that come forth after the Tree hath been once pruned) for every bough that breaks out, breaks out through the Bark; and hath its Root between the Bark and Tree that Year, and as the Tree increaseth, so that knot is deeper and deeper in the Body of the Tree: thus taking off the small Boughs often, keepeth the Tree clearer from great knots within the Timber, and the little knots do cover over so soon before the out-side of the knot be dead, that they become as clear Timber.

Thus have I shewed you, that all sorts of Trees come to have clear Bodies

Bodies by pruning, either Natural or Artificial; that is by Cattel cropping, by under-wood beating off the side-boughs, or by standing close one to another, and so drawing up one another, and smothering the side-boughs by standing so thick, or by pruning, &c.

*Reader, if thy Faith hold out, Read on;
But if you find you can't believe, be gone:
For, with more ease a Man might undertake
To bring Brute Bear unto the Fatal Stake,
Than him to Teach, whose Infidelity
Does Demonstration, Reason, Truth defie.*

Thus have I shewed in part how to Raise and Order the Oak from the Acorn, till it is thirty or forty Years old. There is one thing more to be known, which is, how to Remove an Oak that is large (or other Tree) and that was never Removed before; I shall borrow part of it from the Learned Esquire *Evelin's Discourse of Forest-trees*, p. 13. Choose a Tree as big as your Thigh, saith he, (but if less, the better to grow, Remove the Earth from about him, cut through all the Collateral Roots, till with a Competent strength you can inforce him down upon one side, so as to come with your Ax at the tap root; cut that off, and cut all the Roots smooth on the under-side, re-dress your Tree, and so let it stand, covered about with the Mould you loosened from it, till the next Year, or rather longer. then take it up at a fit Season, and you will find it will (at those ends where the Roots were cut off) have drawn many tender young Roots, apt to take, and sufficient for the Tree wheresoever you shall transplant him: further to facilitate the Removal of such great Trees or small ones that are ticklish to Remove, for the Adornment of some particular place, or the rarity of the Plant, there is this Expedient: A little before the hard Frosts surprize you, make a Trench about your Tree, at such distance from the stemme as you judge sufficient for the Roots; dig this so deep till you come lower than the side-roots, if your Ground be a dry Ground, water the Hill of Earth, the Frosts will lay hold on it the more, but commonly in Winter before Frosts we have showers saves you that Labour; then lay some Litter in the bottom of your Trench, which will keep that part from freezing, in case you have Occasion to undermine it more to loosen it when you take it up, as is very likely you will: Thus let it stand till some hard Frost do bind the Earth firmly to the Roots, and then convey it to the Pit or Hole prepared for its new station, having before covered the Earth by with some Horse-Litter to keep that Earth

from

from freezing, which Mould will then be ready to cover that clod round the Root of the Tree, and the ends of the Roots, and so secure it the better; and that Litter will do well to lay round the Tree on the top of the Ground.

But in case the Tree be very great, and the Mould about the Roots be so ponderous as not to be removed by an ordinary force, you must then have a Gin or Crane, such a one as they have to Load Timber with; and by that you may weigh it out of its place, and place the whole upon a Trundle or Sledge, to convey it to the place you desire; and by the afore-said Engine you may take it off from the Trundle, and set it in its hole at your pleasure. By this Address you may transplant trees of a great stature without the least Disorder, and by taking off the lefs of their Heads, which is of great Importance where this is practised, to supply a Defect, or remove a Curiosity.

I do suppose that one of these small Cranes or Gins would be very useful to those that have a great many pretty big trees to take up in their Nurseries, especially such as have strong and tough Roots; for if the Ground were but well loosened round the Roots, and a Rope well fastened a little above the Ground to the stemme of the tree, I dare engage, that this way one Man with a Lever shall draw up more than ten Men: And besides, this will draw upright, which is better than drawing on one side, as many are forced to do. You must have on the lower end of the three Legs, pieces of Plank, to keep it from sinking too far into the loose Ground: I have now one a making, and hereafter I shall be able to give you a better Account of it than now; the onely Inconvenience I think of at present, is, in fastening the Rope about the Tree so, that it may not slide, or gall the tree; but a piece of good Leather, about four or five Inches broad, with three or four Straps to come through so many holes, when it is fastened to the Rope they may all be strained alike; this I suppose will do your work. The afore-said Learned Author Adviseeth you, before you take up trees, to mark them all on one side, the better to place that side to point to the same Aspect it did before: For, Oaks growing on the North side of an Hill, are more Mossie than those that grow on the South-side: this I grant, because that side is Colder and Wetter; for it is Cold and Wet Ground that breeds Moss most, and that gets from the Ground upon the Trees: Also he says, that Apple-trees standing in a Hedge-row, after the Hedge was taken away, the Apple-trees did not thrive so well as they did before, for want of the shelter of the Hedge. I say, that if the Hedge-row had drawn up the Apple-trees so as to make them top-heavy, they might not thrive so well; but if they were not, the shelter being taken
away,

away, they would thrive the better : unless by thriving he means growing in height : See Lord Bacon's *Natural History*, p. 113. For a tree pent up cannot spread.

But as for placing the South-side of a tree South again, this is not the purpose ; for the greatest time that Trees grow in, is from the Sun's entering into *Aries* to his entering into *Libra* ; and all that time (that is, half a Year) the Tree hath the Sun on the North-side both Morning and Evening, and the North side hath the benefit of warming it self later in the Evening, and earlier in the Morning, having two hours time earlier, and two later in the height of Summer, more than the South-side : Again, you shall have the Cold be as much on the South-side of a Wall or Tree in the Night, as on the North, if the Wind blow on the South-side ; therefore I do Judge that to place a Tree the South-side South again, signifieth little, though the same Author saith, p. 88. and the Author of the Book, Called [*Mathematical Recreations*] p. 75. saith, That a Tree groweth more on the South-side than on the North ; I have oft Observed the Annual Circles, and have found as many, nay more, to the contrary ; for thus I have always found, on a Tree near the Ground the Annual Circles have been the greatest on that side from which most of the great Roots came : As if a Tree grow on the South-side of a Bank, you shall find the Circles on that Tree to be greatest on the North-side, &c. but higher on a Tree the Circles are ever greatest on that side the Tree where there is a great Bough breaks out, for the Sap has great recourse thither ; many times by sudden cold some is stayed by the way, and so increaseth that side of the Tree most.

For I take the Sap of a Tree, if the Weather be open (that is, of those Trees that shed their Leaves) to be still ascending into the Head, though it be Mid-winter ; though there do not rise enough to keep the Leaves on, nor to make it bud forth, yet it is plain that it keeps the buds full and fresh, and increaseth the growth of the Tree, for that same pory substance of the Tree which is between every Annual Circle that is made by the Winter-sap ; and the milder the Winter is, the greater you shall find this to be, as is visible in Ash, Oak, Elm, &c. The other, which is more hard and clear, is increased by the Sap in Summer ; and the more feeding the Summer is by showers, the more shall the Circles increase on dry Ground ; and according to the Nature of the Ground that the Tree Loves, and the depth of the Soyl, so doth the Tree increase in these Circles and growth in all parts.

Between these Annual Circles doth some Sap rise, as is plain in a tree that is Barked round, for that tree shall put forth Leaves and increas-

in Body, but produce little or no shoot, and the more porous the tree is between these Annual Circles, the longer that tree will Live, as accidentally I have had it Experimented on Walnut-trees, Ashes, &c. And they have continued sometimes two years, and sometimes near three before they have dyed, when they have been barked quite round the stemme, a Foot or more; and by way of Experiment I cut off the Bark from a Holly-tree and a Box-tree about half a Foot clean, quite round the stemme or body of each tree, and the tops of both did die in less than one years time, which informed my Reason, as much as though I had Learned it out of the most Learned Author, that the Sap of those trees that shed their Leaves, doth in a small quantity ascend between the Annual Circles, in that pory place: for trees that hold their leaves, their Wood is close, and Compact between the Annual Circles, and that is the Reason that they die soon, being barked round: Also their Sap being of a Turpentine and Clammy Substance, is the Reason they hold their Leaves all Winter, being as it were glued on by that Substance; and the Sap of such Trees as hold their Leaves, being once set by cold, requires a pretty deal of heat to make it thin, and set it on Motion: As Comparatively, a little Cold will set or make stiff Pitch or Turpentine; but it must be Frost that sets or stays the Motion of Water.

Also those Trees which hold their Leaves will grow much better under the dropping of other great Trees, than those that shed their Leaves; for their Turpentine-sap shoots off the drops, so that they have little or no harm by such a Scituation,

Put in case you should have a Tree Barked round by Accident, and would willingly preserve it, your best way is to get a shoot below the wounded place, and if your Tree be Young, you shall then have several break out a little above the Root, if you find they shoot strong, preserve two of the strongest, and see that the Barked place be near the Ground; but if your Tree be Barked high from the Ground, or that it shoot up slowly, then leave but one shoot, keeping all other that shoot out clean taken off, as soon as ever you see them break out; so Nourish up the two shoots or shoot till you have got them higher than the wounded place; then cut a long slit in the Bark, above the wound, and joyn in that shoot exactly, making it fit the slit, the in-side of one bark right against the in-side of the other; tie it close in, and Loom it over with good and well tempered Loom, to keep the Air and wet out; or better with soft Wax. The Spring is the best Season, but if you fear your Tree to decay, defer not, but do it as soon as your shoots be shot long enough.

If you would be further satisfied concerning the Largeness and Usefulness

fulness of this Royal Tree, see Esquire Evelyn's Discourse of Forest-trees, who hath writ very well of this and others; but before I bid adieu, I must Plant these few unpruned Verses, and so leave the most Useful Oak.

*O Stately Tree! Who right can speak thy Praise
 Doth well deserve the Lawrel or the Bays.
 Ask but our Thames what Burdens thou hast bore
 Of Gold and Silver fine, and in their ore,
 Of Rubies, Diamonds, and Pearls most rare,
 With others which past valuation are.
 Of Silk and Sattins fine to Cloath the Back;
 Of Wines, Italian, French, and Spanish Sack:
 Of Spices, Fruits, and many a Rich Dye,
 To Satisfie and Feast the Curious Eye:
 Of Mastick, Myrrh, and many a Rich Gum;
 Aloes and Druggs which from the Indies come.
 He who Loves this thy Burthen, and not Thee,
 He deserves never to be worth one Tree.
 'Twas Faithful Oak preserv'd our King, that we
 Might thence Learn Lessons of true Loyalty.
 Kings, Lords, and Earls, and Men of Low Degree,
 Transported are by this our Royal Tree;
 Oak Walls our Seas and Island do inclose,
 Our Best Defence against our Forreign Foes.
 No thing on Earth but Oak can Time Redeem,
 No Wood deserving of so high Esteem.
 When in Salt Seas Sir Francis Drake did stear,
 Sailing in Oak he sav'd one day i'th' Tear.
 His Oak which the Terrestrial Globe did Measure,
 Through Dangers led him t' Honour, Profit, Pleasure.
 No Wood like Oak that grows upon the Ground,
 To make our House and Ships last long and sound;
 No Oak like Ours: By Love to Oaks let's then
 Appear true Subjects, and right English-men.*

CHAP. XI.

Of raising and Ordering the Elm.

THere are several sorts of Elm, but the best sort (because it produceth the greatest Trees, and soonest comes to perfection) is that which hath its Leaves not much less than Line, or Lime-tree leaves, and shoots with a shoot not much less than a Sallow when it is lopped: it is called by some the Trench-Elm, by others the Marsh-Elm. Some other sorts there are that are not much inferiour to this for producing high and good Timber. One sort there is that hath on the young shoots great pieces like Cork, subject to spread in head much, and grow crooked, this is not very good to make high Trees, but makes good Pollards: Another sort there is which I see in *Essex*, the sides are subject to have Wens thick on them, which makes the Body hard to cleave: this is not very good to make a high Tree, but good Pollards.

All sorts of Elms doe increase from the roots much of themselves; and the more you take, the more they will give, provided you keep them from being taken from you; that is, from being spoyled by Catel, and though they be so kind of themselves, yet there are several wayes to increase them, but the way to have of the best Kinds, and to make the finest Trees, is by raising them of seeds.

Therefore about the beginning of *March*, or about the tenth, you shall find the broad things like Hops begin to fall, which have the seed in them; when you find these begin to fall, in a dry day (if conveniently you can) gather what quantity you please to sow, then lay them thin in some place where they may drye four or five dayes, and then having prepared a Bed (in bigness according to the quantity of your Seeds) of fresh light Brick-earth, sow the seeds and their Vessels all over, then sift some of the same Mould all over the bed, for they will not well rake in; let them be covered about half an Inch thick; if the Summer prove drye, water them sometimes, and keep them clean from Weeds; let not weeds stand on your bed till they be great, lest in pulling such up you spoyl their spearing, by breaking it off, or by letting in the drye Aire, and so kill it; therefore keep your Beds clean from weeds, and about the middle or latter end of *August* they will be come up:

up: About the midst of *September* sift a little richer Mould all over the Bed, but not so much as to cover them, thus doe the next Summer, and take off the side boughs though young, and when they have stood two years on that Bed, then plant them on beds in your Nursery, keeping them with digging and pruning up yearly, till you have got them to the stature you think convenient to plant abroad. In setting this or any sort of Tree forget not to top the ends of the tap-root, or other long ones, and also not to leave a bruised End uncut off. You may set them in streight lines in your Nursery, about a yard one Row from another, and about a foot and a half one Tree from another, in the Rowes; mind the Natural depth it first did grow at, and set it so when you remove it; have a care of setting any Tree too deep, and also keep not this Tree nor a Walnut long out of the ground, for their spongy Roots will in a little time grow Mouldy and be spoyled: Therefore if you cannot set them, let them be covered with Earth, and then you shall find this Tree as patient in removing, and as certain to grow as any Tree I know.

The ground they like best is a light Brick-earth or Loom, as I said before; that they dislike most is, a rocky ground, or a stiffe clay; but if one have a mixture of Brick earth, &c. and the other of small Gravel, Drift-sand, Sand, &c. then there they will do pretty well.

They naturally increase very much of themselves, and the more where they meet with natural ground: if you fell a thriving Tree, and fence in the place, you then may have a store to furnish your Woods and Hedge-rows with the worst; and the straightest to nurse up in your Nurseries, for to make VValks, Avenues, Glades, &c. with; for there is no tree more proper for the certainty of its growing, especially if you make good large and deep holes, and where the ground is not natural, there help it by some that is, and then you may hope for a stately high growing Tree, if you take care in pruning it up, as is before shewed of the Oak. You need not much fear its growing top-heavy; for it having such a thick bark, the sap is subject to lodge in it, and break out many side-boughs, and the Roots apt to break out with suckers, the more when pruned, therefore prune it up high, and often, but let the season be *February*, for then its fine dark, green-coloured Leaf, and long hanging on it, is the more ornamental, and fit for walks.

As for the way to increase it from the Roots of another Tree, I doe referre you to the *seventh Chapter*, which will shew you fully how to perform the same; observing but them Rules, you may raise many fine

young Trees from the Roots of another, much better than naturally they will be produced from the Roots.

I advise you where you find your ground Natural in your Hedge-rows, there to plant some of this most usefull wood; for it will run in the Banks, and thicken your Hedges with wood, and is very courteous to other sorts of wood growing by it.

Do not let ignorant Tradition possess you that it will grow of the Chips, or of Truncheons set, like Sallows, though the Author of the *Commons Complaint* saith it will, for I assure you it neither doth nor will.

In Lopping of this, be carefull to cut your boughs close and smooth off, minding to keep them perpendicular to the Horizon, the better to shoot off the wet,

It will grow well of Laying, (as is before noted and also directed in the *Chapt.* of Laying) in which if you take but a little labour more than ordinary, from one Tree you may have (in a few years) many in your Hedge-rows or elsewhere; therefore deferre not, but put this in practice, especially the great Kind: My Lord *Bacon* adviseth to bud it, to make the Leaves the larger, but that is needless.

Part of these Rules I wrote some years agoe, at the request, and for the use of the truly ingenious Planter, and Lover thereof, Sir *Henry Capell*; and I shall give you the same Conclusion now, that I did then to him, which take as followeth.

*Since Gard'ning was the first and best Vocation,
And Adam (whose all are by Procreation)
Was the first Gard'ner of the World, and ye
Are the green shoots of Him th' Original Tree;
Encourage then this innocent old Trade,
Ye Noble Souls that were from Adam made;
So shall the Gard'ners labour better bring
To his Countrey Profit, Pleasure to his King.*

CHAP. XII.

Of Raising and Ordering the Ash.

AND as for Raising the Ash, I shall give you the same Rules as I did to the aforesaid Honourable Person the same time, before the Discourse of Forrest-trees was written.

Let your Keyes be thorow ripe, which will be about the middle or end of *October*, or *November*: When you have gathered them, lay them thin to dry, but gather them off from a young straight thriving Tree: My Reason to gather them off a young thriving tree, is, because there will the Keyes, or seeds in the Keyes, be the larger and solider, therefore by consequence they are the abler to shoot the stronger, and to maintain themselves the better and longer: Though I know by experience that the seeds of some old Plants will come up sooner (so the seed be perfect) than the seed of young Plants; and also that old seed, (so it will but grow) will come up sooner than new Seed. My aforesaid Reasons do in part demonstrate this: Or thus, Nature finding her self weak, doth (like a provident Mother) seek the sooner to provide for her weak Children: for Nature is one in divers things, and yet various in one thing.

Now if you gather them off from a straight tree, 'tis the likelier they will run more up, and grow straighter than those which be gathered off a Pollard or crooked tree: for it is well known, and might be proved by many Instances, that Nature doth delight in Imitation, and the Defects of Nature may be helped by Art; for the great Alterations which many times we find visible in many Vegetables of the same *species*, they all proceed either from the Earth, the Water, or the Heavenly Influences; but the last is the greatest Author of Alteration, both in Sensibles, Vegetables and Animals. However, Like still produceth its Like; and since there is such plenty of Forrest-trees that bear seed, you may as well gather all sorts of Keyes and Seeds off or under such Trees, as not.

As for the time of sowing them, let it be any time between the latter end of *October*, and the last of *January*; for they will lie till Spring come twelve Months before they appear: if your ground be not very subject to great weeds, you may sow them with Oats, if you be minded

mind to make a Wood of it ; and in your VVoods on the top of your Ground ; but if they be prepared before-hand, they will be much more certain of growing : therefore if you would be sure to raise good store of them for to make VValks, or furnish your VVoods with, &c. having gathered your Keyes, and ordered them as is aforesaid, prepare some sifted Earth, or Sand, which is better by keeping an equal warmth and moysture, to prepare them for spearing. Having prepared your sand, and a house to lay them in, where the Air may freely come, then in this House lay one Laying of Sand and a Laying of Keyes, parting your Keyes well ; so doe till you have (Laying after Laying) covered all your Keyes in the Couch, any time in VVinter, as is before directed : Let your Sand be pretty moyst, and so keep it all that year ; and having prepared your Ground by often digging, and a tender Soyl, (which the Ash loves) then about the latter end of *January* sowe them on this Bed, covering them about one Inch, or an Inch and a half thick : Do not let them lie too long uncovered when you take them out of their Couch ; for then they will be speared, and if they lie too long in the Aire, it will spoyle them : Do not sowe them in frosty weather ; but if Frosts be, stay till they be over.

Mind to keep them clean from weeds the first year, for they will shoot but little the first year, but the second they will shoot strongly : the VVinter after you may transplant them upon Beds, pruning the little side-shoots, and topping the tap-root. Keep them with digging and pruning every year on these Beds, and in few years they will be fit for Walks, Woods, &c. and one of these thus ordered, shall be worth ten taken out of VVoods, for they will be taper and fine trees. VVhen you remove an Ash, take not off his head, if he be not too top-heavy, that you can possibly help it ; for an Ash and a VValnut are two of the worst Trees I know to head, they having such a great Pith : but the side boughs you may be bold to take off, provided you take them off close, and the Boughs not very great. It is not very apt to break much into side-boughs, and heals over the wound as well as any tree except the Beech ; then why will you have low Timber-trees of Ashes, when you may as well have high ones ? Therefore prune up your young Ash-trees well and often : And if you follow but these Rules, you may raise them as easily as Barley, and as thick.

As touching the several Kinds, some Authors will have two sorts, the Male and Female : but there is no such thing as Male and Female among Plants, though some Plants are so called ; for what Act of either do any two Plants communicate to each other ? The greatest
diffe-

difference that ever I observed in young Ashes, among the many thousands that I have raised, was in their Bark; for I have had some that have had blackish Bark, some reddish, the Leaves alike, but what difference there will be in the Keyes and Timber, I yet know not.

The Ash is not fit to be set near fine Gardens, for the Leaves turn to soyl suddenly, and so spoyle your VValks; also the Roots run so shallow that they will rob your Borders, and spoyle your Fruit-trees: They are as bad by your plow'd Ground, for the Roots will so draw the strength of the Ground from the Corn, that it will languish and pine away. And this I have observed, that the Summer after a Tree is lopped, it shall rob the Corn more than another bigger standing by it, as may be visible by the growth of the Corn: I have wisely experienc'd it, and I conceive the Reason to be this; the Sap riseth into the head of the Pollard (as usually it did) and so into the Boughs, but finding the Boughs cut off, it filleth the Head so full, that it causeth it to swell in the Spring; and this is the reason Pollard-heads are bigger than any other part of the body of the Tree; the head being so full that it can contain the sap no longer, it then breaketh out into abundance of young shoots, and when they set once a growing they grow apace, and so the Bark of them being thin and open for the Sap to run in, they receive as much as the Roots can possibly provide for them, and endeavour to enlarge the Head to that magnitude as it was at before.

But though the Ash doth harm to grow near or upon plowed Ground, yet it is the usefullest wood that growes, for the Plough and other uses belonging to the Plough-man. It is a quick-growing wood, and will grow pretty well on most sorts of Grounds, provided they be not too wet, or very shallow: It grows best on such Grounds as have their surface of a loose Nature, so that it be not too shallow. It produceth excellent Timber for several uses, and is such a quick-grower, that from a Key, in Forty years, one Ash was sold for Thirty pounds sterling, as witnesseth the ingenious Author of the *Discourse of Forrest-trees*, pag. 22. And this I can tell, which my Lord and I measured, of the shoot of an Ash that stood between the Wood-yard at *Hadham-Hall*, and a place where I used to raise Melon plants; that the second years shoot was Eight foot within two Inches; which had it shot but a few years at this rate, it would soon have been a very great Tree, and worth a like price.

Of all the VVood that I know, there is none burns so well green
as

as the Ash; and that is one Reason that many a fine Pollard is spoyl-
ed: For your bad Husbands (as they are tearmed) are as unkind to
Trees as they are to themselves: For their want of Wood early in
the VVinter, makes them flie to the Ash, whence they hack off the
Boughs, and thus leave him all Winter; in which time the wood be-
ing not very hard, that drinks in the wet at these wounded places,
and before the Spring comes to heal it over, decays, and so by that
means every Winter receiveth the wet more and more, till it hath de-
stroyed Root, Body and Branch.

On the other side, there are some which will not lop their Trees till
they bear very great Boughs; and then lop off them, (smooth and
well cut off) though it be in the Spring; yet in such great wounds,
before the Sap can cover the place, the wet makes a hole in some or
many of these places; and so you lose both Body and Lops in a few
years. Besides the lopping of Trees young, that is, at ten or twelve
years at the most, by so doing you keep your Tree much the longer
alive; and you shall have shoots of Trees at first felling, grow more
into wood in one year, than they do when old Lops in two or three,
and in all Respects are as usefull for the Fire: Then I intreat you be
not so wilfull, as to make you and yours poor, and also spoyl your
trees.

Therefore in lopping of Pollards, especially soft wood, let it be
towards the Spring, and let not your Lops grow so great, as to
spoyl your trees and lose the use of your Money. If once you find
your Pollard grow much hollow at the Head, down with it as soon
as may be, for it then decays more in the Body than the Lop comes
to; and if your Timber-trees be dead-topt, or most of the Head dead,
or that you find Wood-peckers, or Nihills make holes in them, then
sell them as soon as the season is, (which is from *October to February*)
for when they begin to decay, they decay apace.

I know it is the Opinion of most men, that these Birds spoyl their
Trees; but let me tell you, they rarely make holes in sound Timber,
therefore Learn of them, and sell the trees of which they give you
warning by making holes in them: the sooner the less Timber lost.

CHAP. XIII.

Of Raising and Ordering the Beech.

OF the Kinds of Beech I know but one, though some say there be more.

About the middle of *September* you will find the Mast begin to fall apace, then gather what Quantity you think good to sow, and as soon as your seeds be drye, make a Couch of Sand, as you are before directed for the Ash, and sowe them before the Moneth *September* be past; Keep them in the Couch moderately moyst (not so wet as you keep the Ash) untill the latter end of *January*, then sowe them in a bed of light gravelly Earth, made on purpose: Or if you fancy to sowe them in your Woods, that is the best time; or you may sowe them in the Month *September* in your Woods: But if you keep them in the House all Winter, and sowe them at the first Rise of the Spring, you will preserve them from Mice and other Vermine the better; they affect a gravelly light Soyl, and will not thrive on Clays: If you would make a Nursery of them, your Ground must be accordingly, or else they will thrive but badly with you.

Of all VVoods that are, this may the best be pruned up; for it growes over the place in little time, and is not subject to break out side-boughs: It is fitting for Walks where the Ground is Natural for it, but it is so nice in its ground, that I do think there are few VValks of any great Length, but have some Veins of Ground it doth not like.

C H A P X I V.

Of Raising and Ordering the Walnut.

BEfore we come to Raise this Tree, or Gather the Nuts, there may be these Enquiries made.

First, you will desire to know what kind of Nut is likeliest to produce the best Fruit; and to know what Kinds will alter from that Kind to a better (as most Kinds of Fruit will degenerate, some for the better, and some near the same, and some worse) as also to know the very Nut, or Nuts, and other sorts of Fruits which will do so.

As for the Kinds that are likeliest to produce the best Fruit, and the most likely to produce better, Observe to gather your Nuts, Stones, or Kernels off from some young thriving Tree, that is in its Prime of bearing, and hath the Kernels plump, large, and full, and of the best sorts; and if it be of Fruit that is too subject to Ripe late with us, then let it be of the earliest Kinds, and as for the latest Kind, preserve them for Stocks onely: also if it may be, make choice of such Fruit as is lately produced from some other good Kind, and is better than the Kind it came of; for you cannot expect to have as good an Apple produced from the Kernel of a Crab, as you may have from the Kernel of a good Pippin: for if the one bring you a good Wilding, and the other an Apple, either more large, or more beautiful, and as good, if not better, and of different taste, this is as much as can be well expected: for Nature doth not run her Journey all at once, but makes several small ones, and many times more backward than forward, the better to encourage Ingenious Men to try and observe her ways: but to those that are diligent she often drops her blessings, and requites them well for their diligence. And if you would obtain a blessing in you Works by Nature, you must frequently be begging it of the great God of Nature, and by his assistance and your diligence, you need not doubt accomplishing you Lawful desires: Of this Truth doubt not.

The Lord Bacon, in his Natural History, tells you of an Old Tradition, that boughs of the Oak put into the Earth, will put forth Wild Vines. I wish all such Old Traditions were buried in the Earth in room of the Oak-boughs.

He

He tells us also of an Old Beech-tree cut down, the Root whereof put forth a Birch, See p. 111.

This most Learned Man, in his next page lays down six Rules (though all, as he confesseth, untried by him) concerning the transmutation of Plants.

The first is, if you would have one Plant turn into another, you must have the Nourishment over-rule the Seed.

The Second is, to bury some few Seeds of the Plant you would change, among other Seeds.

The Third is, to make some Medley or mixture of Earth with some other Plants bruised, or shaven, either Leaf or Root.

The Fourth is, to mark what Herbs some Earth does put forth of its self, and to sow some contrary Seed in that Earth.

The Fifth is, to make an Herb grow contrary to its Nature.

The Sixth is, to make Plants grow out of the Sun, or open Air; as in the bottom of a Pond, or in some great hollow tree.

I might and could Answer to all these, but I think it would be too tedious; for I do verily believe, that to sow Seeds any way that can be devised by Man, will not in the least cause them to be quite another kind of Plant; for if you find any alteration, in any Plant that is, it is from the Conception and Nativity of the Seed; for there is no real alteration but by Seed. I know that Plants or Trees may bring fairer, or smaller Flowers, or Fruits according to the Ordering and Natural Situation of the Ground, and the contrary: For it is in vain to think, that the Kernels of an Apple will bring forth a Pear, or a Pear an Apple; or that Cherry-stones will produce a Plumb, or Plumb-stones a Cherry: But if you sow the Kernels of good Pears or Apples, &c. then you may expect good Fruit, and of different taste, shape, or bigness, as is afore-said; for I do believe all our sorts of Pippins come from one: the Burry-pear from the Green-field, the Pettit Roufelet from the Katharine, &c. And so of Walnuts, or other Fruit; and what should be the Reason then we do not Raise as many new sorts of Fruit as the *French*? And though I do deviate a little from my intended Discourse, I shall shew you that we can do it as well as they, and I suppose better, though we do it not; but before I proceed to give you further Judgment of it, I will in some measure Answer my Querie, which was, to know the very particular Fruit that will alter for the best: I do not affirm it as true as the Gospel, but onely conclude according to Reason.

First, it is known by Experience in Flowers to be true; that such Flowers as differ in number of Leaves, in shape, in Colours, the Seeds of such will produce Flowers much different from the Ordinary Kind

of Flowers, though produced all of one Flower but a Year or two before; nay, a particular Flower among many others, of one Plant, shall bring more double ones than twenty others that are not so qualified as it: this is apparently known to all that take delight in Raising of Flowers, that the Stock-gilly-flower that hath Flowers of 5, 6, 7 8, or 9 Leaves, that the Seed of such a particular Flower or Flowers will produce more double ones than those Plants that bring forth but four leaves, Quantity for Quantity of Seed, twenty for one: You may know these Flowers before they blow out in the bud; I confess this Flower doth shew this by its Leaves more than any other I know; for this Flower having no thrum in the middle, as the most of Flowers have, Nature hath given it this Sign to inform Man, that those that have a Leaf or Leaves added to them more than their usual kind, will bring forth those with many Leaves, and make a fine double Flower; which when it hath attained to, it then is come to the bounds of Nature, which the Almighty hath allotted it, saying, *Thus far shalt thou go, and no further*: for when it is thus a double flower, it never beareth Seed more, but by endeavouring blows it self to Death.

If you be Curious, you may observe the same Rule in several other flowers that have no thrum in the middle, as Auriculoes, Prim-Rose, Wall-flowers, Campians, and several others; and when you find on Leaf or Leaves more than the ordinary number, you may conclude there, Nature hath set one step forward in altering from the ordinary Kind; therefore if you be a Lover of Plants, or a Servant of Nature, be diligent, and whensoever you see your Mistress step out of Door, then do you wait upon her to her Journeys end, for 'tis on the Diligent she bestows her Favours.

Also those flowers which bear Seed when double, as the Gilly-flower, *African*, &c. Sowing the Seed of such double flowers, they will bring you more and better flowers a hundred for one than single ones; and in sowing the Seed of such, you shall have several Varieties, but most marked with the colour the Mother-plant was of; and some of these will, as it were, run beyond the limits of Nature, and then they will break, or have pods in the middle, and then never bear Seed more. Gilly-flowers have their sign, which will bear Seed, and which not: Those that will bring Seed (if Weather or other Accidents hinder not) have their Hornes in the middle of the Flower.

It is also observed in the marking of flowers, that the Seed of those that be striped shall bring the most striped ones, and some of different Colours and stripes, their Seed all alike. But it may be Answered, that this may be true in flowers, for none can deny it, but that such flowers will

will alter, and bring forth such flowers as afore-said: but can the altering of the Fruit be known by the flower?

To this I Answer, that you have not onely the Leaves of the flower, but the thrum and the Fruit it self, to inform you which will alter; therefore by the Shape, Colour, or Thrum in the Flower, you may know which fruits will alter, and it is possible, which will alter for the best; for it is commonly known, that fruit will alter from the fruit they come of, by sowing the Nuts, Kernels, or Seeds.

Now, when you have made choice of your Seeds, Stones, Nuts, Raise them as is Directed in each Chapter of the Kind, in good fresh Ground, and by Midsummer that Year they will have shot so strong, that you may take off Buds of some sorts, and of all sorts the next Year, having in readiness some fine thriving stock against some good Wall, for that will make the fruit set the sooner when it comes to blow: At a fit Season bud these Stocks, if Pears on Quince-stocks; if Peaches, Nectrons, or Plumb, on some large white Plumb-stocks, &c. If they be Apples or Walnuts, they may be from the Wall: bud your Apples or Codlins, or Apple of Paradise (which is a sort of Dwarf-sweeting, and will grow of Cuttings; if Walnuts, on a fine Young Walnut tree, bud it five or six foot high; this doth not onely alter the Property of the Wild Kind, but it makes the Tree more Naturally bear fruit much sooner and better, if well Ordered; your Pears, Plumbs, and Peaches will bear in three or four years after, your Apples and Walnuts in five or six years after.

I know my Lord Bacon tells you, that Peaches come best of Stones, unbudded, but I advise you to bud all you Raise of Stones, Seeds, &c. though it be to take a bud off from the same stock, and to bud it on that, as I have often done.

Those that have great Grounds to look to, and good Ingenuity, let them but put this in Practice, and I am confident they will find great satisfaction therein, and in a little time Raise many new sorts of fruit.

Now, the Reason why in *France* they Raise more Varieties of fruit and flowers than we do, is this: there are many Ingenious Men in their Monasteries, and there they being Seated as long as they Live, there they Raise many fine fruits and flowers,

Now, if our Noble Men that take delight in Gardens, as all that are Ingenious do, would provide themselves of good Ingenious Gardeners, and allow them good Encouragement, with assurance of continuing in their Service so long as they carry themselves carefully in their Employ, and are faithful in their Place; this would certainly cause them to improve their Places, much for their Masters good and Profit, and
their

their own Credit, or give them Patents for their Places, as His Majesty does to the Gardiners he keeps, for which I hope none better served. A good Cook can Dress you several Dishes of Meat very well in half a day, and if one miscarry, they can in a little time make another; but the Gardiner must have several Moneths or Years, to bring some things to Perfection; and if He miscarry, he cannot begin again when he will, but he must wait his time with Patience; therefore he ought the more to be careful.

But for this Digression I must crave your Pardon; and thus I have shewed you, that it is not the mixing of Earth with other Plants, that will make them change into such Plants as you mix the Earth with, or make the Plant alter to any purpose; for the main alteration of all Plants is from their Seed; though it may be, mixing such Plants or Shavings with the Earth you sow Seed in, may cause them to have some quality of the Physical use of the Plant in them; as is the Opinion of the Learned, that Misceltoe on the Oak, and Polipody of the Oak, and Elder on the Willow, &c. do partake of the Physical uses of those Plants on which they grow: for in Nature you may find, that many Bodies do not onely by their Qualities Affect their Adjacents, but also infuse their Virtue into them, and endue them with the same faculty; as the Loadstone doth not onely attract Iron, but Communicates its Virtue to it, and makes it Magnetical by touching, &c.

But I shall leave the Stones, and return to the Walnut-tree. Let your Nuts be very Ripe, and when they begin to fall, then beat the rest off from the Tree, and lay them by, that the outward Husk may Crack, then peel them, but do not wash them, for wet doth make the Kernel Crack, and Mould, and spoils it: When you have taken off the Husk, lay them thin to dry in some dry open Room, turn them sometimes with a Broom.

When they have sweat, and are dry, about the beginning of *October* put them into Sand a little moist, making it a little wetter about *Christmas*, for then they will begin to spear, and then will digest it: Sow them not in their Husks, neither steep them, as some Advise. Set or Sow them about the latter end of *January*, or beginning of *February*, in good fresh Ground, minding the aforesaid Rules, and you shall not lose one in a hundred; and cover them about an Inch and a half, or two Inches; keep them well Weeded on their first bed, and when they have stood two Summers, then Remove them into other beds, setting them about a yard asunder, one Row from another, and about a foot and a half one from another in the Rows: Cut the Tap-root and all bruised Roots off, and the side-boughs, but cut not off the Head of a Walnut-tree.

Keep

Keep them with digging, and hoing, and pruning up, till you have got them five or six foot high, then bud them, it will make them bear sooner, and then you are certain of a good Kind; for I presume you will not bud them with a bad Kind, if you know it.

If you do not bud them, let them Head about six foot high a year or two, and then Remove them; but keep them not long in the open Air, for the Roots being of a spongy Nature, will take in the Air so fast, that they will soon Mould, and Kill your Tree, therefore set them as soon as you can, when once taken up.

Remove them young off from the Seed-bed, as is before Advised; for if you let them stand to be great on the place where they were first sowed, they will be much more dangerous to Remove, and not so likely to thrive.

The Ground they Love is a deep Soyl, and of a dry Nature, on a sharp Gravel, if the Ground be shallow, they will not prosper, but if the Gravel be mixed with Loom, they will do well: They Love not a stiff Clay, but if it be mixed Naturally with stones or Chalk, and not too shallow, then they will thrive on it.

It is a proper Tree to set in Woods, for it will run up (if the side-boughs be taken off) to a great height, and yield very good Timber for many Uses.

CHAP. XV.

Of Raising and Ordering the Chesnut.

Touching the Kinds of this Nut, there may be several, but I know but three; one of them is very good, which ought to be the more Increased.

For the time of Gathering, Observe the same as before is said of the Walnut: When you have gathered them, and taken the Husks off, lay them to dry and sweat, but not too thick.

Do not steep them in Water, as some Advise you, for it is not good to steep any sort of Seed, unless some Annuals, and to steep them is good, especially if lated in sowing; but to steep Stones, Nuts, or Seeds that are not of quick growth, watering them may Kill them, by making the Kernel swell too hastily, and so crack it before the spear causeth it; or it may Mould and stupifie the spear; therefore let no Seeds whatsoever,

soever, that are not quick of growth, have too much wet at first.

You must put your Chesnuts (then) in Sand, a little moist, about the beginning or middle of *November*; make it a little moister about the beginning of *January*; and at the latter end or beginning of *February*, sow them on beds, and cover them about two Inches, or you may set them by a Line, as you set Beans, or you may sow them in drills, as Beans, or, you may sow them where you intend they shall stand; and in any of these ways or places keep them clean from Weeds the first or second year, then you may Remove them into your Nursery off from the Seed-bed: prune off the side-boughs and Roots.

They are Subject to put forth many side-boughs near the Ground, whereby they may be increased by Laying very easily, to do which, see Chap. 5. But the best way is to Raise them of Nuts.

Set them in Rows in your Nursery, and Order them as is shewed of the Walnut.

The Soyl they Love is such as the Walnut takes delight to grow in.

They be Excellent to set in Coppices or Woods; the Timber is very Useful, and they will grow to be large for under-wood; if the Tree be much crooked, fell it, it will yield great store of strong shoots from the stemme, some of which it will be convenient to Lay, whereof you may leave some Layed to thicken the place, and others to Plant where you please, and may have great shoots from the stemme for several Uses also.

CHAP. XVI.

Of Raising and Ordering the Sarvice-Tree.

AS for the Kinds of the Sarvice, they may be many; there is one whose Fruit is much better than the other, but whether it is the Ground makes it so I cannot positively say. We have them grow at *Hadham* on very stiff Ground; the Trees bear well, and the Fruit is good: and at *Cashibury* we have them on a sharp Gravel, the Fruit naught, and the Trees bear very badly.

It may be Raised of the Seed or Stone that is in the Berries, which, when they are rotten, are then Ripe; that is, about the latter end of *September*, or beginning of *October*; eat off the Fleishy part, or rub it

off by Rolling them in Sand, then dry them in the open Aire, and keep them in moist Sand till the beginning of *January*, then sow them on moist Ground, or in the shade; keep them from weeds, then let them stand two or three Years, and then plant them in your Nursery, as you are directed for Walnut-trees, there keep them with digging and pruning till they are fit of stature to plant out; they grow in good shape, and last long: it is a fine tree for VValks, it likes best a strong ground, but let it be good, and there they will bear store of Fruit, and grow to be large, fine Trees.

They be very subject to put forth suckers, by which they be easily increased from the Roots of the Mother-tree: but how to do that see *Chapt. 7.* there you may be fully satisfied how to raise them.

When you have got them to five or six foot high, bud them; they will bear sooner, more, and better, &c.

CHAP. XVII.

Of Raising and Ordering the Cherry-tree.

I Know many will say, that it is not proper to rank this among Forrest-trees; but if such did but see the fine stately Trees that we have growing in the Woods at *Cashibury*, they would then conclude it proper for Woods; and if for Woods then for Forrests.

Where they like the ground, they make a glorious shew in the Spring, their white Blossoms shewing at a distance as though they were cloathed with fine white Linnen; their Blossoms are a great Relief to the industrious Bees at that season: the way to raise and order them is as followeth.

And first you must know, that the best way to raise them, is of Stones. Let your Cherries be very ripe, for the riper your Cherry is, (or any other Fruit) the plumper and better is the Kernel.

The time they be Ripe is according to the kind, but it is the black Cherry which growes common in Woods and Hedges about *Cashibury*, which is the Tree fitting for VVoods, and therefore how to Raise it I shall shew, though there be much difference in these also; for we have some full as large and good as the *Corowne*, and at a place called *Red-heath*, at one Mr. *Baldwins*, they have someforts not inferior to the black *Orleance*, which are produced naturally from the

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Stones.

Stones, without Budding or Grafting, or any other help but the Nature of the Ground, which indeed is very natural to them.

They are ripe in *July*, and the largest sorts are ripe latest; the Fowls of the Aire will give you notice of their time of being Ripe, by their visiting them, which are as so many Messengers to awaken the industrious to take care in time to preserve them; and to the careless man and Sluggard, to take that away from him which he will not take care of: For, as the wisest of men saith, *Prov. 20. The Sluggard will not plow by reason of cold, therefore shall he beg in Harvest*; so he that will not take care in time, shall want when others have. But we have such store, that what the Jack-dawes, Jayes, Mag-pies, &c. eat, they are not missed with us; and though the Fowls do begin to eat them as soon as they turn blackish, yet Nature hath tied them on so fast to the stalks, that they can but take off part of the flesh, and leave the Stone and rest to feed the Kernel; for the wonderfull wise God hath ordered most sorts of Fruit so, that some by their bitter, fower, or other tastes, are so well defended, that neither Bird nor Beast will touch them till the Kernels be ripe, or near it, and then the fleshy part and Kernels also are pleasing to their Pallats.

When the Fruit is Ripe gather them, and have the fleshy part eaten off, or taken off, by rolling them in Sand that is drye, with some heavy Plank upon them, drawing it too and again to take off the flesh; when you have so done, drye them for three or four dayes, then put them into pretty moist Sand, and so keep them till the beginning of *February* in house, and then sowe them in a Bed of light gravelly Mould; if your Bed be not naturally so, make it so; keep them clean from weeds for two years, and then you may plant them in Woods, Coppices, Hedge-rows, &c. or in your Nursery, to raise other Kinds of, or there to stand till they be fit for walks; for where the Ground is Natural, they be very proper for walks. The ground they like, is a dry Soil, the bottom Gravel, the surface mixed with Loom.

Or you may sowe them on Beds as soon as you have taken the flesh off, and they will do very well, and come up the Spring following, and then you may plant them at two years shoot, where you please; but if you keep them too long out of the Ground before you sowe them, they will lie two Winters in the ground before they come up.

Note this, that all sorts of Stone-fruit would be committed to the Earth as soon as the Fruit is Ripe, the Flesh taken off, and the Stones a little drye: for all sorts of Stone fruit, if well kept, and sown or set in time, will come up the Spring after, but if you keep them too long
out

out of the Ground, they then will stay till the second Spring, and sometimes never come up at all.

At any time when you Remove a young Cherry-tree, you may prune off his head close, if you please, to one shoot; for they Naturally grow taper and straight: They are subject to increase from the Roots of another Tree, but if you would help Nature in Raising of them that way, see *Chap. 7.*

It is a good wood to plant in Coppices, for it produceth a strong shoot, and it is (like the Elm) apt to put forth several young Trees from the Roots of other Trees; but especially if you fell a tree that is not too Old, and it be in a light Ground: for then it will bring many from the Roots of one tree, and so thicken your wood much. It produceth great Trees in a light ground, that being the Soil it liketh; but in a stiffe cold Ground it is not so ready to grow, nor bring such fine high taper trees, nor increase so from the Roots, as it will on light ground. Once I measured a Cherry-tree in *Cashibury* Wood-walk, first by the Quadrant, and so I found it 85 foot high; but for more Exactness (being the Tree leant, by reason of another which was blown upon it by a high wind,) I saw it measured by a Line let from the top-shoot to the Ground, and it was 85 foot five Inches, therefore I think such trees as this might well be accompted among Forrest-trees.

When you transplant young Cherrie-trees, do not set them too deep; nor indeed no other sort of tree, but especially those that naturally run shallow, as all sorts do that be subject to put forth young Trees from their Roots, such is the Elm, Abele, Sarvice, Cherry, &c. This tree is wanting in several parts of this Land: But you that want it, I would counsel you to get it as soon as your Ground is convenient for it.

CHAP. XVIII.

Of Raising and Ordering the Line-tree, Or Lime

THIS Tree is called by most Herbals the Line-tree; or Linden, but vulgarly the Lime-tree: But call it which you please, for I shall not trouble my self with the Etymology of the Name.

Of this Tree there are but two Kinds, that I know, one of which is

the broad-leaved, and this shoots with a stronger shoot than the other; the broad-leaved one is much to be preferred before the other, for the aforesaid Reasons, and several others: of the broad leaved Line we have had, of late years, several trees from *Holland*.

I have raised several hundreds of Seeds of this sort. The narrow-leaved Line grows plentifully in several places of this Land, as in several of my Lords Woods in *Essex*: This latter is harder to remove with good success than the former: the Reason is, because it hath not been so much used to be transplanted, therefore not so certain to grow as the great-leaved; according to our old Proverb, *Use makes Perfection*.

Some Authors tell you, that they are Male and Female, but there is no such thing in Plants; for both these Kinds bear seed, but it ripens not every year with us in *England*.

You may raise this fine Tree by Seed or by Laying, either way with great facility, and great Increase: But of this, as of all other Trees, to raise them of Seed is the best way: For my Honourable Lord, and the Honourable Sir *Henry Capel*, have seen such difference between those raised of Seed, and those of Layers, that when they were Trees of eight or ten years growth, they have often told me which was raised from Seed, and which from a Layer; for that raised from seed, much out-growes the other, and keeps its Taper-shape for several years after they be planted out in Walks: The taperness of the Seed-tree makes it grow as straight as an Arrow; but this I advise you, that when you gather the Seed, you mind to gather it off from some of the broad-leaved Line-trees, and of those that shoot with a strong shoot: But as I told you before, the Seeds do not ripen every year with us; but you may know that, by cracking the husk or shell of the seed: for if the Seed be good, it will lie plump and full under the husk, the body white, if you bite it in two. But if the year be not kind for the Seed, most of the Husks or Seed-vessels will have nothing but a little chaffie substance in them, and some few will have some small lank seeds in them.

But to our Purpose; to raise them of Seeds, let your Seed be very Ripe, which will be in *October*, gather it in a drye day, and after you have dryed it about a week in an open Room, then put it in a Couch of Sand, indifferent moist, so let it be kept till about the middle of *February*, then sow it under some Wall, on the North or West-side, in some good, fresh, Loomy ground, rather strong than light; if there come a drye Spring or Summer, keep them indifferent moist, and stick some Boughs over them, to shade them from the scorching Sun, especially

especially if they be much exposed to it; keep them clean from weeds; there let them stand two Summers, and afterwards you may transplant them into your Nursery, and set them in Rows, as you are directed of the Walnut and other Trees before. Prune them up to one shoot, unless you find some shoot or shoots that are fit to Lay, and then, if you would increase a Stock, Lay them. This tree is very apt to put forth shoots a little above the ground, and Suckers a little within, so that it is very readily increased by Laying: Lay your Layers betimes, any time between *Midsummer* and *November*, as they be strong and fit to Lay: And in a Twelve-months time or little more, they will have drawn Root fit to be transplanted into a Nursery: Thus by seed and Layers you may in a little time encrease enough for a County, which when you come to have great store, you may plant some of your crookedest Layers in your Woods; they will produce a large Stub, strong shoots, grow well almost of any Ground, and are very good Fire-wood.

It is a Tree that loves pruning up well, for it naturally growes taper, especially those which come of Seed; but if it shoot much, and thrives apace in your Nursery, then leave some side boughs to check the Sap, lest by forcing it all into the Head, it shoot out so much there, that it make the head too big for the Body, and so (being top-heavy) make the Tree crooked: Now if ever you see your Trees in such a Condition, then immediately cut off the leaning side of the Head, which when it is lightened of its heaviness, and hath not long stood crooked, it will then come straight again; *Midsummer* time is the time of this pruning, but do not force the Sap too much into the head, lest by high winds you have many of your Heads broke off. But of this I have spoken before.

My ingenious Lord was once too free in pruning up a parcel of those Trees; which I the rather acquaint you with, that you hereafter may avoid the like; for the Ground was fresh and good, so that some by their great Heads lost them, and some grew crooked: But despair not, for if you observe what I have said before to make a crooked Tree straight, you may easily bring them to be straight again, for they naturally delight to grow as straight as most trees doe; and if the Head should be broken off, (as very seldom it is, because the Bark is so tough) they will yet shoot with such a strong shoot, that they will in a little time make a fine Tree again.

You may (if occasion be) transplant them pretty large, as big as your Legge, but the surest size is about two-Inches Diameter, and eight or ten foot high.

But

But if the Tree was never Removed from the place where it was first sowed, then Remove it the sooner; for if it be great, there's the more danger in Removing it, and the topping of the Roots when removed young, makes it break out near home, with many young feeding Roots like a Maple: Therefore my advice to you that take delight to raise Trees, is, to transplant any sort of Tree while young, and to top the Roots a very little; they will be much the better, and certainer to grow when they are again removed, and will come forward much the better: They that take this Advice, will find the profit of it in Trees, which will the better encourage the practice of it.

They will grow as well on any sort of Ground, as any Tree I know, but they like best a feeding Loomy Ground, which is not too wet, as is before said in *Chap. 8.* where I have spoke somewhat of this fine Tree, for Walks, Avenues or Lawns; This being a Tree I fancy for the aforesaid uses, before any Tree we have in *England*, though I know many do not love it that are Planters, because it is not good Timber; and I grant it is not, but to vindicate what I have said of it for Walks, I shall lay down these following Reasons.

1. I doe suppose with my self, that whosoever is a Lover of VValks, will not fell the Timber-trees in a stately VValk, while the Timber is in its prime; for most Trees will continue many years very Ornamental, after they be in their prime, even while they be fit for no use but Fire-wood; and why not the Line then for VValks as well as any sort of Timber trees?

2. It will grow as well on different Grounds as any Tree I know, which is a considerable encouragement to the ingenious Planters, to see their Labours prosper.

3. It will grow as great and as high, if kept with pruning up, as most Trees we have: For the Greatness of it, I shall borrow the words of the Learned *Dr. Brown*, which he writ to Esquire *Evelyn*, as he hath it in his *Discourse of Forrest-trees*: *Chap. 29. pag. 82.* His words are these: *An extraordinary Large and Stately Tilia, Linden or Line-tree there groweth at Depenham in Norfolk, ten miles from Norwich, whose Measure is this: The Compass in the least part of the Trunk or Body, about two yards from the Ground, is at least eight yards and a half; about the Root nigh the Earth, sixteen yards in circuit, the beighth to the uppermost Boughs about thirty yards, &c.* This is one of the Broad-leaved Lines, which how great and stately they grow, you may observe out of this wise and learned Doctors Discourse, who commends this Tree with the Epithets of *Large and Stately.*

4. It will last sound long, as appeareth by the Greatness of its growing.

5. It is a Tree will soon grow over the places where you cut off side boughs, and is not subject to put forth many.

6. It is a Tree that naturally groweth taper and straight.

7. No Tree keeps such a constant Pyramid-shape as this; the Heads of other Trees growing of several shapes and Forms, though all of one Kind, this keeps its Head as if it were cut, and the Body straight.

8. For Shade few better, having a thick Head, and large Leaves, only it droppeth his Leaves too soon.

9. The Bark of this Tree being tough, keeps its Head from breaking off by great Winds.

10. It's a Tree that as seldom blowes aside as any Tree whatsoever, for it's matted Root and Taper-body preserve him upright all his Life time.

11. The Flowers are beautifull, the scent counted healthfull, and breaketh out strangely on the side of the Leaves, much different from other Flowers of Trees or Plants.

12. The shoots being of a fine red glossie colour, are very pleasing to behold in the Winter-season.

13. It is a Tree that seldom grows hollow in the Body, for it soon evergroweth the wound, and so keeps himself sound, both Body and Limb.

14. It is the best wood for Carving that is known.

15. At last when he is dead, his Bark will make you Mattes and Ropes, usefull for several things.

16. And lastly, its Wood is a good, sweet, free-burning Fire-wood: the Charcoal made of it, is commended before all others for Gunpowder.

Now put all these together, and judge if this be not a fine Tree for VValks; but if you would have them shape themselves finely, set them two rod asunder: if for a shady walk, what distance you please.

I fancy that a single Rowe, to bound a Lawn round, set two or three Rod asunder, would be mighty obliging to the Noblest Sense, for then they would shew themselves more clearly than when set in double Rows to make VValks; or they would shew mighty well set thin on the side of a Hill, one topping another, with their curious natural shapes. And so adieu my beloved Line-trees.

*If treating of the Line I've wrote amiss,
I'll thank you if you'll shew wherein it is;
But if you meet wth anything done well,
Say nothing on't, but study to excell.*

CHAP. XIX.

Of Raising and Ordering the Maple.

THE Maple-tree is very plentiful in most places of *England* where there are any Hedges or VVoods; but as for the Kinds, I know but one sort, though Authors tell you of more.

It is increased, and doth increase it self by Seed and Layers, and from the Roots of Mother Old Trees, and by Suckers, which makes it so plentiful.

The Seeds will lie a year in Ground before they come up, therefore you may order them as is before said of the Ash; you may increase it by Laying (as is directed in *Chap. 5.*) for to thicken your VVoods or Hedges; but if you let it grow into Trees, it destroyes the VVood under it; for it receives a clammy Honey-dew on its Leaves, which when it is washed off by Rains, and falls upon the Buds of those Trees under it, its Clamminess keeps those Buds from opening, and so by degrees kills all the wood under it: therefore suffer not high Trees or Pollards to grow in your Hedges, but fell them close to the ground, and so it will thicken your Hedge, and not spoyle its Neighbours so much.

You may increase it from the Roots of an older Tree, as is shewed in *Chap. 7.* It is a good VVood to plant for under-wood in Coppices and VVoods, for it produceth a good shoot, and thickens your VVoods. it loves a dry Ground or Bank best.

CHAP. XX.

The Raising and Ordering the Sycamore.

THis fine Tree is much out of Favour with a great many, for these Reasons, *viz.* Because the Leaves falling upon their Walks, turn into Soyl soon, and so spoyle them, breeding Grasse, and Weeds.

And also that notwithstanding its fine shade, it is not good to plant
them

them near Dwelling-houſes; for the Leaves in Summer-time being ſubjeſt to catch and hold the Honey-dew, do draw together ſeveral ſorts of Flies, and (ſome ſay) amongſt them the Moth: if ſo, they be not fit to be planted near Houſes and Gardens: the ſame fault hath the King of Trees, the never enough admired Oak, and the Maple and others.

But granting this, yet let me deſire thoſe that have Woods and Coppices in Parks, where Deer are eſpecially, to ſet ſome of this Tree every Fall, in the open places, and that for theſe Reaſons: Firſt, it is a wood the Deer will not ſoon harm, then it is a wood that bears Keyes ſoon, and many, which will fall Early and come up the next Spring; and being armed with a large Leaf, the weeds will not ſoon choak them: On ſome Grounds that are dry and light, it groweth faſt: It produceth tall, tough and good Timber for ſeveral uſes: It groweth apace from a Stub, and is good Fire-wood.

It may be raiſed of Seed, which is beſt, or by Laying, or by Roots: Sow the Seed (not on too wet or ſtiſſe Ground) as ſoon as it is Ripe, and the next Spring it will come up; whereby on a little Ground you may raiſe a great many Plants to ſet in your Nurſery; keeping them clean from weeds by digging and pruning up every year, till you have got them big enough for Walks, Woods, or what you pleaſe. Thus much at this time of the Sycamore, onely remember (as I ſaid before) that it is a good wood to plant in Coppices and Woods.

CHAP. XXI.

Of Raiſing and Ordering the Hornbeam.

I Told you but now of the Sycamore being fit to be ſet in Parks, becauſe Deer do not often Bark them; but of all Trees that I know for that purpoſe, this is the beſt; for a Deer will ſterve before he will ſo much as taſte the Bark of the Hornbeam, they do not love much the very ſmall tops.

This Tree may be raiſed of Seed, or by Laying; but by Seed is beſt, though the young Seedlings be tender. The Seeds may be ſown at the time directed for the Aſh; for it lieth a year in the Ground before it comes up, and then you muſt look to keep it well ſhaded, or elſe it will ſooner be gone than you think for: It naturally loveth to grow on ſtiſſe ground,

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where

where it will grow, and bring great Lops to the Owner, when the Tree is but a very Shell, as indeed most Old Trees are hollow within; which I judge not to be the Nature of the Tree so to grow, but the fault of those that look to them; for they have too many Masters which be bad Husbands, and no Friends to this Tree and many others, as the Elm, Ash, &c. who let the Lops be great before they lop them, perswading themselves that they have more great wood, which is most usefull, never considering that great lops do endanger the Life of the Tree, or at best wound it so much, that many Trees decay more yearly in their Bodies, than the yearly lops come to; and so indeed they do provide themselves with more great wood, though it be much to the Owners loss; though this Tree will bear great Lops when there is nothing but a shell of a Tree standing, yet the Ash (if once come to take wet much at the Head) it rarely bears more Lop after that the Body of the Tree decays: Therefore if once a Tree decays much at the middle, it will soon be little worth else but for the Fire: But in case you find a Timber-tree decay (as is aforesaid) down with it in time, for fear you lose your Timber, and also the Fire-wood be spoyle; but of this I have spoken before, and would also speak more, could I with words but perswade men out of this great Error: But our ordinary Husband-men will vindicate Their Countrey-Husbandry to be better than the next, for indeed Countreys do differ much in the ordering of Trees and Hedges, and they as much condemn ours: for it is as hard to perswade them out of their self-conceited Opinion and Tradition, as it is to make a Jew turn Christian.

This tree makes the very best Hedges of any Tree we have in *England* that sheds the leaves, (I mean for Ornament:) for you may keep it in what form you please, and it will grow very thick to the very Ground; Therefore to make a private Walk, or to fence in Avenues, at a convenient distance, without the bound-Range of Trees, or Walks; or to hedge in Ridings, Causeways, or to make close Walks or Arbours, this Tree is much to be commended; especially on such ground which it likes: You may be better satisfied about this Tree at *Hampton-Court*, in his Majesties Garden, which is kept by the ingenious Artift and my good Friend Mr. *Tobias Gatts*: It is good Fire-wood, and yieldeth good Increase both from Stubs and Pollards.

It encreaseth much by sowing it self, therefore you that love planting get a few into your Plantations, and try whether they will thrive with you or not; which doubtless it will on many Grounds where now it is not, and so would many other Trees doe mightily well in VVoods and Coppices, to thicken them, and make them the more beautifull, especially

especially those that increase from the running Roots, as the Noble Elm, Cherry, Sarvice, Abel, Popler, &c. and some others, for to seed if you have them not, as Ash, Sycamore, Line, Hornbeam, Maple, Quickbeam, &c. and with those which you see thrive best, you may at every Fall furnish your woods where they be thin, and I do assure you it will pay you for your pains with Interest.

CHAP. XXII.

Of Raising the Quickbeam.

THE Quickbeam, VWhitchen, or VWild-ash, though very scarce in the South parts of this Land, is pretty plentiful in some parts of the North, as in *Nottingham-shire*, &c. and would be there more plentiful, were it suffered to grow great, to bear the greater Quantity of Seed; for I think it increaseth (as the Ash doth) onely from seed: It produceth straight, small and long shoots, which in that Countrey they cut off while they are young, to make Goads (as they call them) or Whips to drive their Oxen with, for it is as tough a VWood as most is.

I do ghes the seeds lye a year in the Ground before they come up, I am now about trying to raise some. Let me desire some kind Planters to get some of this VWood into their bounds, where it is not, that it may be tryed whether it will grow in the South or not, as no doubt but it will if you will but trye: I shall say no more of this Tree, because I cannot yet speak much on my own Knowledge.

CHAP. XXIII.

Of Raising the Birch.

THIS Tree increaseth from the Roots or Suckers, and for ought I know it may be raised of Seeds; for I do suppose there are Seeds in that which it sheds in the Spring, though I have not yet tryed.

It delights to grow on your hungry Gravel, as it doth about *Cashbury* in severall VVoods: Therefore you that have barren Ground where your VVoods be, get some sets of this VVood, to help to thicken your VVoods; for though it be one of the worst of VVoods, yet it is very usefull, and the great God hath ordered it to be contented with the worst of Grounds; and besides, that it should not be despised by his Servants, he hath endow'd it with a Faculty of Attracting and preparing from the Earth a very Medicinal Liquor, which is both pleasant and healthfull for man; which to take from the Tree, and also to prepare this Water, and to demonstrate what Diseases it is good for, I shall make bold to borrow out of Esquire *Evelyns* Discourse of Forrest-trees, pag. 32, &c.

About the beginning of *March*, with a Chizzel and a Mallet cut a slit, almost as deep as the very Pith, under some Bough or Branch of a well-spreading Birch: Cut it oblique, and not long-wayes, inserting a small Stone or Chip to keep the Lips of the Wound a little open; fasten thereto a Bottle, or some other convenient Vessel appendant; out of this Aperture will extill a limphid and clear water, retaining an obscure smack both of the Taste and Odour of the Tree: thus may you obtain this water. I will present you a Receipt how to make it, as it was sent me by a fair Lady (saith he.)

To every Gallon of Birch-water put a quart of Honey well stilled together, then boyl it almost an hour with a few Cloves, and a little Limon-peel, keeping it well scumm'd; when it is sufficiently boyled, and become cold; adde to it three or four Spoonfulls of good Ale, to make it work, which it will do like New Ale, and when the Yeast begins to settle, bottle it up as you do other winey Liquors, it will in a competent time become a most brisk and spirituous Drink, which is a very powerfull Opener. This Wine may (if you please) be made as successfullly with Sugar instead of Honey, *lib. 1.* to each Gallon of water; or you may dulcifie it with Raisons, and compose a Raisin-wine of it. I know not whether the Quantity of the sweet Ingredients might not be somewhat Reduced, and the Operation improved, but I give it as Received.

For Distempers in Man it is good for Cure of the Prylick, most powerfull for dissolving the Stone in the Bladder, curing (as I am told) Consumptions, and such interiour Diseases as accompany the Stone in the Bladder and Reins: This Liquor is so strong that the common sort of Stone-Bottles cannot preserve the Spirits, so subtile they are and volatile; and yet it is gentle and very harmless in Operation within the Body, and exceedingly sharpens the Appetite being drunk *ante Pastum*.

Passum. This from the Learned Author, and thus much of the Birch:
And now I proceed.

CHAP. XXIV.

Of Raising the Hasel.

OF the Kinds there be many, and some very good Fruit, as the Red and VWhite Filberds; the great *French Nut*, &c. also your wild Nuts do differ much in shape and goodnes. My Lord had once a Quantity of very good sorts sent him from beyond Sea, they had a very tender Shell; therefore I took care to raise some of them, and did severall, but when they came to bear, they were no better than our Hedge-nuts.

VWhen they be Ripe I need not tell you, for every Boy can; order them all winter as you are advised to keep your VValnuts, and sowe them at the same time in the Spring; they will grow almost on any Ground, (provided not too wet) but best on your dry ground: therefore set them on your high and dry Banks, between your Fences, but Early in Winter: if they hold but the first year, they will produce good Stubs; you may increase them by Suckers, or Laying, but the best way is from their Nuts. I would have you to benefit your self by Laying this and other Woods in your Woods, that be thin of wood: I dare assure you that for every Shilling you lay out in this Husbandry, in a few Years time every Shilling shall be paid you yearly, for many years after.

CHAP. XXV.

Of Raising the several sorts of Poplers.

THere may be many sorts of this VWood, but I know but Four; the best is that large, white Popler; a great leaf white on the lower side, it shoots with a strong whitish shoot, which the *Dutch* call *Abele*.

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The Second is a fort much like to this, both in Leaf and Shoot, which grows in many places of this Land, and is in most places called the white Popler.

The Third is a fort that hath the leaves and shoots more small, and not so white; it groweth in many places, and in most of them is called the Aspen or Asp-tree: These three sorts are to be ordered all as one: the other differs much both in the Nature of growing and ordering: therefore a word or two of these.

I never yet did Raise any of them of Seed, but I do believe they have a Seed in that downy substance they shed in the Spring; they increase naturally very much from the Roots, but they may be help'd much by the Rules in the Chapter before, which sheweth you how to raise Trees from the Roots of another Tree; by which Rules, from two of the *Abele* Trees my Lord had from *Holland*, I have raised above a hundred: But if you fence in a place round the Tree, to keep Cattel off, and keep down the great weeds a little, they will put forth many young Trees from the Roots of an old one, especially if you prune up, or thin the Heads of any of these sorts, they will then yield the more; but if you do not value your Mother-tree, but desire to get a great stock of young ones, then you may fell the Mother-tree at the ground: and if it be not very young, or old, the Roots will put forth in young Trees, the Quantity of the Body and Head of that Tree: and so will the Elm, Cherry, &c. then how usefull such Trees are to set in the places of VVoods that be thin, I leave you to judge.

Though this Tree is none of the best of VVoods, besides the afore-said Properties, I can satisfie you it will grow and increase on the very worst of your grounds, as well drye as wet.

You must forbear to head any of these three sorts, unless young, or that you leave some young shoots to draw up the sap; except you are minded to destroy the old one you head; for if the Lops be very great it many times kills, or makes the Tree hollow; therefore lop young. Some will tell you they grow of Chips, but that is false, they rarely will grow of Cuttings.

They are best in VVoods, though some advise you to plant them in VValks; but they be not good for walks, for the Suckers they produce from the Roots, will be troublesome: The greater sorts are proper to set on the East, VVest, or North Prospect, at a distance, in or by the side of a wood; for their white Leaves shew finely when the Sun shines upon them, and make fine variety with other Trees that have dark green leaves. I commend them to you for to plant in woods of barren ground; for there they increase much, and yield much wood:
And

And so I leave them, and come to the other, which differeth from these both in Leaf and Shoot, and manner of growing.

This last kind is in most places called the water-Popler; its Leaf is a pale Green, shaped something like the other, but it is not white below; the shoot is of a yellowish green, this loves to grow by Rivers sides, or in Ground that is wet, or such as holds water much: Therefore you that have such Grounds, get some of this Tree to set in them: It will grow of Truncheons from two foot long to eight: the first being the best to set for Stubs, the other you may make Pollards of, for it is a good profitable wood, bringing a good Lop in few years, and that on some Grounds better than the Willow.

For your instruction in setting the small setts, see *Chap. 6.* and for setting those of six, seven, eight or nine foot long, for to make Pollard-trees, keep the lower end of your set, and also the upper, free from cracks, and cut each sloping off; as for the bigness, let it be about two or three Inches Diameter: If you make your hole with an Iron Crow, make it big enough, that you do not thrust up the Bark when you thrust them into the hole; or if you make them with a Stake, observe the same; but if you fear the Bark to part from the wood tie it about the lower end with a piece of Wier, &c. set them about one foot and a half deep; if great, deeper; or if you have a quantity to set, and would set them well, then have an Auger made, somewhat like to a Pumps, a little bigger than your sets, so may you set your sets in, and ram the Earth close to them; but however you set them, be sure to Ramme the Earth close to them: I preferre the beginning of Winter for the best season, unless your Ground be very wet, then deferre it till *February.*

But if you have ground that is wet and barren, and that you are minded to plant, make Dreins two spade-deep, and a yard wide, and at every two yards asunder cast up the Earth upon the two yards of ground you left, and sow it the first year with Oats, to mellow the Ground, which may pay a good part of your Charge, if not all; the next Winter set it with these sorts of woods, Water-popler and others, Alder, Willow, Withy, Sallows, &c. and in four or five years after you may have a good Fall of wood, so may you have every five or six year after, for many years.

To encourage you, Esquire *Evelin* tells you of an Abele that did shoot in one year seventeen foot in length, and as thick as your VVrist; and also informs you of some VVillowes that have shot no less than twelve foot in one year. Therefore to those Gentlemen that have wet or moorish Ground, which is bad and will not grafe well, do I di-

teft this good Husbandry, especially where wood is scarce, and sells well : The Charge to do this will not be great ; and to satisfie you the more, I shall here shew you, if you dig two spade-deep, then there will be but one third part of ground to dig ; that is, to dig your Trenches one yard wide, and leave two yards there to lay the Earth, and to sow one year, or to set the sets as soon as you have made the ground ready.

	160 Rod in one Acre, divided by 3 gives one 3d. of 160,
1 (1	which is 53 and $\frac{1}{3}$. This 53 doubled (neglecting the $\frac{1}{3}$ as
160 (53	needless in such a business) is 106 ; Now if I allow 3 d. a
33	Rod for one spade-deep, that is 6 d. for two ; and then
	2 d. a Rod for setting, is 8 pence the Rod, leaving the Sets
	out, and not counting them, because I do not know the scarceness or
	plentifulness of them where you intend to plant, though they will cost
	but little : Now if I divide 106 by 2, being 2 Six pences
106 (53 s.	is one Shilling, it gives 53 s. and then divide 106 by 6,
2	being 6 Two pences makes One Shilling is 17 s. 8. d.
By this it appeareth, that if the Ground be	
4 (4	planted this way, having the Trenches digged
106 (17	two foot deep, which is the best way to
66	plant any sort of Ground if the soyl be shal-
	low, (as I shall shew fuller hereafter) the
	Charge (excepting the Sets) is but 3 l. 10 s. 8 d.

where men can dig such ground for 3 d. the Rod.

But if the Ground be not very wet, or the Soyls surface very shallow, then may you dig one yard, and leave another, throwing half your Earth on one side, and half on the other : Suppose you were to plant an Acre of Ground this way, there will not be half digged, especially if the ground be an oblong square ; but if you count it at half, that is 80 Rod, which at the same price, 3 d. the Rod, is 20 s. for if you divide 80 Three-pences by Four, (the Thirds in a Shilling) the

80 (20	Quotient gives 20 : then 80 Two-pences for setting is 13 s.
44	4 d. for if you divide 80 by 6, (the Two-pences in one Shil-
- — —	ling) it gives 13 in the Quotient and 2 over, which 2 Two-
2 (2	pences is 4 d. that is then 13 s. 4 d. and 20 s. is one pound
80 (13	13 s. 4 d. charge. Yet as I told you, the more oblong the
66	piece is, it will cost somewhat the less, provided you divide

your ground into yards, or as near it as you can, and leave a yard next the side where you begin, and one at the side where you end.

Having shewed you the Charge, or pretty near it, and also two
ways

wayes how to prepare your ground, you may set Truncheons of VVater-popler, all sorts of Sallowes, Alder, VVillowes, Oziers, &c. of Roots, Abele, Popler, and if not too wet, Elm, Ash, &c. Let none of these soft woods stand too long unlopt if Pollards, or unfelled if Stubs, for the Reasons before mentioned. Of all the Poplers, VVater-popler indures best lopping when great, then the Abele, the Asp worit when the boughs be great: This VVater-popler doth not increase of a Runner as the other doth; I suppose this is the same which some call the Black popler: It growes in several places about Ware, by their Ditch-sides, and brings them good profit; and therefore you that have wet grounds get some of this to set by your Ditches, one Rowe of this, and one of VVillowes; for if you set one of these worth a half penny, if they grow they will bring you that yearly for twenty years or more. Prune all soft woods at the latter end of VVinter, &c.

CHAP. XXVI.

Of Raising the Alder.

THIS Tree may be raised of Truncheons as the other I last writ of; some say of Seeds, but if you cut them about two foot and a half long, and set them two foot in the ground, if the ground be proper for them they will certainly grow, and yield you good Profit. They love a wet moorish ground, and will not grow on dry ground; they will grow well on your boggy Grounds, which seldom yield good Grass.

Some advise you to fell them every third or fourth year, which is good Counsel: but do not deferre above five or six years, the wounded place will be too great if you stay longer, and with wet will grow hollow (if it be great) before it can overgrow the wound. As for soft VVoods, or Aquatick Trees, fell or lop none till to wards the Spring, viz. *February* is the best Season, and the Moon encreasing.

CHAP. XXVII.

Of Raising the Withy, Willowes, Sallow, Oziers.

THE Withy doth best grow on ground that is not very moyſt, but yet the moyſture muſt not be far from him; as on the weeping ſide of a Hill, where ſome Spring breaks out, or on Banks by Rivers or Ditches ſides, or on Banks in your Moorish ground, &c.

The VVillow loves to grow on ſuch like ground; both this and the former are ſet in ſuch places as the Water-popler is, and of ſuch ſets as it is; to make Pollard trees, ſee the Chapt. before of the Water-popler, and Chap. 6. which teacheth how to ſet all ſorts of Cuttings; Remember to keep them well fenced for two or three years, and to cut off all the ſide-ſhoots, which they will be ſubject to put out below the Head, and thin the head as you ſee it convenient, leaving not above fix or eight for Arms; ſo doing will make the body of your Tree ſwell, and lay hold on the Ground the better.

And as for the variety of Kinds of theſe and the following, I ſhall not trouble my ſelf to inquire after; for I intend only to ſhew you how to Raiſe them, not to deſcribe them, and if you know how to raiſe ſome, you may then ſoon be able to raiſe them all: But there is one ſort more which is called the ſmelling VVillow, which deſerves to be taken notice of; it ſhoots a great ſhoot, bears fine, broad, ſhining, green Leaves, and will grow on moſt Grounds that are not too drye. It bears a ſweet beautifull Flower, and worthy to be ſet in Orchards: You that have Rivers run by your Orchards plant ſome of this, if you have not, yet if your ground be moiſt, and pretty good, it will grow mightily, and yield Ornament and Profit.

It is eaſily increaſed of Cuttings, which if ſet as is ſhewed in Chap. 6. will grow every one: Only mind if your Ground have a dry Bottom, then ſet them on the North ſide of a wall; beſide the Beauty and Smell, the induſtrious Bees love it much: It is as eaſily increaſed as any Sallow, and bears as good a Lop, then endeavour to make it as common. From one ſmall Plant I have Raiſed ſome hundreds, and have ſet ſeveral in our VVood-walks at Caſhibury, where they grow well notwithstanding our dry Ground, but they were Rooted before

I set them there: I commend the like Husbandry to the Lovers of Planting: And to those that are Lovers of that busie Martial Creature, for it's an Early Relief to them. It may also be very plentifully increased by Laying, for if it be but covered with ground, it will Root.

Of Sallows there be three common sorts; all of them love a moist Ground, but that with the Round Leaf will grow on Banks, as in Hedges; for if you set them for Stakes they will take root: And though they be no very good Fence, yet they will yield good Profit: The two other grow best on Moorish ground, and there will yield great shoots, they will grow of Cuttings much, and may be increased well by Laying; both which wayes you may thicken your Woods very much: but then you must keep out Cattel, especially all Deer, for two or three years and above. They may be raised by seed, as the Elm is, some years, for the seed is not all years good with us, no more is the Elm and Line: I have raised many of them of seeds in the downy substance, but they be so easily increased by Cuttings and Laying, that you need not trouble your self to raise them of seed. It is as profitable a wood for under-wood in Woods, as any you can set in them for Fire, producing strong and great shoots: Therefore, where you stock up Trees in your Woods, set two or three Sallow Truncheons with some other Wood that is subject to run, as Elm, Cherry, Abele, &c. so may you have a thin wood made a thick good wood; or if you have a Ground that is Moorish, and will not yield good Grass, then plant (as is before shewed) of the Water-popler, and it will yield you quick and great Profit.

If you would see more largely of these Sallowes, &c. see Esquire *Evelyns* 191^b Chapt. He tells you, you may graft Figs and Mulberries on them, and that they will thrive exceedingly: The first is true, you may graft on them; but you had best trye the other, for I fear 'tis borrowed from *Pliny*, &c. but I forbear.

Of Oziers there are several sorts, and are all raised of Truncheons, as the Sallow: They love a moister and more Moorish ground than the Sallow or Willow. The Basket-makers know best the time to sell them, which may be done any time in Winter, they must be kept well fenced from Cattel, and thus I shall conclude of the Aquatick Trees.

Only let me desire all those that have Moorish ground, and such as yields little Profit, (especially where wood is scarce,) but to make use of these sure Directions, and I do engage you a great and certain Profit.

CHAP. XXVIII.

Of the Pine, Firre, Pinaſſer, &c.

Theſe ſtately Trees want more Reſpect with us than they have : And there are three things which make it ſo : The firſt is Ignorance in planting them ; and that is, they miſs the right Time or Seaſon of the Year to ſet them, planting them when other Trees are planted, as from *November* to *March*, which is the very worſt time in the Year ; but the beſt time to Remove theſe or moſt ſorts of Greens, is, from mid-*March* to the latter end, or from mid-*Auguſt* to the laſt, which are the very beſt times, unleſs for tender Greens, and I ſhall not ſo much as name any of them.

As to the Ground, they love not Dung, but a freſh gravelly Soyl mixed with Loom, alſo mind but the Roots, and they will tell you, that theſe ſorts of Trees muſt not be ſet too deep, therefore take heed you commit not that fault to them ; for if you look into *Gerrards Herbal*, with *Johnſons* Additions to it, pag. 1364. you are there informed by that laborious Author, that Firres grow on the tops of Rocks in great plenty, and alſo large Trees in the cold Countreys of *Norway*, &c. and of Pines that grow in the cold Countreys beyond *Denmark*, as in *Ruſſia*, &c. then certainly they may and will grow here in *England* very well, if you will but mind to ſet and preſerve them.

Then a ſecond Reaſon why men do raiſe but few of theſe, and plant but few, may be becauſe they love them not ; and it is with other men, becauſe they many times die, or do not grow well with them, and this makes them not fancy them : But ſuch Men want good Inſtructions, and I hope I ſhall give them ſome that will make them again in Charity with theſe fine Trees ; but others there be that have ground and fit places to plant Trees in, but mind them not ; theſe men do not love Trees, no nor themſelves, nor their Poſterity.

The third great hinderance of planting theſe and other Trees is, there are many men that love planting and improving of Trees, but are hindered by not having ground of their own convenient to plant in, and if they Nurſe up or plant Trees for their Landlords, they many times meet with but ſmall encouragement for ſo doing ; for many times they
be

be turned out of their Farm before they come to perfection, or if there be any that are come to be fit to fell, many times another man shall have them as cheap as he that Nursed them up in his Hedge-Rows, &c. or his Predecessors.

But I could and do wish that Owners would encourage their Tenants, by allowing them so much Money for every Fruit-tree, and so much for every Forrest-tree they plant in their Grounds, and look to them well till they be past Cattles spoyling them; this would help both the Owner and his Tenant, and many a good Tree might be in waste places where now none is; this would make the Farm much better, and pleasanter, and so we might have more plenty of Fruit and Timber, and Knowledge in Planting would be greatly improved.

Now suppose you should plant on good Land, and in open Fields, you would be no Loser by it: As if you should plant Oak, Ash, or Elm, in Pasture ground, at three or four Rod asunder, they would do your Land no harm, nor would you lose any ground, save only just where the Trees stand; now it must be a good Tree that takes up one yard square, nay the Leaves and Shade may do your Cattel as much good as may countervail the loss of that Land; as if your Land be worth 20 s. an Acre, that is not a Penny a Yard, as here I shall shew; 160 Rod square makes an Acre, and five yards and a half square is a Rod.

You see that in one Rod square there are 30 yards and a quarter; for the Decimal Fraction 25 is $\frac{1}{4}$ of a 100; or thus, 5 times 5 is 25, and 5 halves and 5 halves make 5 whole Rod, and a half and a half make but $\frac{1}{4}$, which is 30 yards and a quarter.

$$\begin{array}{r} 5' 5 \\ 5' 5 \\ \hline 275 \\ 275 \\ \hline 30' 25'' \end{array}$$

$$\begin{array}{r} 30' 25'' \text{ Yard in a Rod.} \\ 160 \text{ Rod in one Acre.} \\ \hline 181500 \\ 3025 \\ \hline 4840' 00'' \text{ yard in one Acre.} \end{array}$$

$$\begin{array}{r} x (4d. \\ *8*8 (403 s. \\ *x*x \\ *x \end{array}$$

Here you see that 4840 (the yards in one Acre) divided by 123, (the Pence in a Shilling) gives 403 shillings, and 4 remain, that is, one Acre at a Penny a yard comes to 20 l. 3 s. 4 d. But it may be sixty years before a Tree takes up so much ground, then at half that Age it takes up but half so much ground, then 60 half-pence is but 2 s. 6 d. and your Tree at that Age, and on such Land, may be worth

30 s.

30 s. or more, which is Profit and Pleasure, &c to the Planter.

But to our business, *Johnson* tells you of some ten sorts of Pines, but I know but two or three in *England*; one is common, and is raised of the Seed sown in good ground, and in the shade, in the Month of *February*: If it be frosty put it into Earth or Sand, and keep it in the house till the weather be seasonable; they will not grow of Cuttings, nor Laying, well; they be bad to be Removed when old, because the Roots run far from the Body in few years, and if broke or cut off, they will not readily break out at sides and ends; therefore Remove them young, at two or three years old, and at the times before said, and then you may expect glorious stately Trees. None of all our green Trees in *England* may compare with them: Prune them as the Firre: They be fine to set round a Garden, or Bowling-green, for the Leaves will not do any harm.

Of Firre-trees we have two sorts, they be easily Raised of Seeds sown as the Pine; one sort will grow of Laying, or of Slips set about *Bartholomewtide*; but then you must cut them one Inch or two from the Body, and cut that Stump close off the *March* following; and cut all other Boughs that be needfull at that time, and you need not fear hurting your Tree, though my *French* Curate be against it.

The best way to keep them is in Stories, about a yard between one another, but do not cut their Ends as some doe, neither let them grow thick on a heap, but if you keep them in Stories they will grow taper, and you may take off some when you see Cause, and so help them up to a great height, and straight as an Arrow, for they naturally grow in a good shape.

Lay the Clogs before the fire, and they will gape, so may you take out the Seeds the better. *Pliny* calls one sort of Pine, the Pinafter; *Johnsons Herbal*, pag. 1350.

CHAP. XXIX.

Of Raising the Yew, Holly, Box, Juniper, Bayes and Laurel, &c.

There be a great many more Trees, some of which shed their Leaves, and some keep them all the year besides; those I have spoken of before, but these be the most of our Forrest-trees; and as for those that doe belong to the Garden, I shall not so much as mention them.

The

The Yew-tree is produced of Seeds, rub the fleshy substance off, then dry them, and when they be dry, put them in sand a little moist, in a Pot or Tub; let this be done any time before *Christmas*: Keep them in house all Winter, and under some North-wall abroad all Summer; the Spring come Twelve month after you put them in Sand, sow them on a Bed; the ground not too stiffe, keep them clean, and prick them out of that Bed into your Nursery, when they have stood two or three years there, you may bring them to what shape you please: It is a fine Tree and worthy to be more increased.

Holly may be raised of the Berries, as the Yew, or by Laying; it loves a Gravelly ground, as most of our Forrest-greens doe; it is a curious Tree for Hedges, and will grow under the dropping of great Trees: It well deserves your love, yet is somewhat ticklish to remove, but the best time is before *Michaelmas*; if your Ground be stiffe and cold, mix it with Gravel, but no Dung.

Box the English and Edged, &c. do grow well of Slips, set about the latter end of *August*, or in *March*: It is very pleasant in green Groves, and in Wildernesses, though it hath a bad smell after Snow.

Juniper is raised of the Berries; it is ticklish to Remove, it is a pretty Plant for the aforesaid places; the Berries are very wholsome; the Wood burnt yields a wholsome and pleasant Perfume, so doth the Plant in the Spring.

Bayes is increased plentifully of Suckers; or you may raise them of their Berries: They love the shade, and are fit to be set in green Groves.

Laurel, or Cherry-bay is increased by Cuttings set about *Bartholomewtide*, and in the shade best, or by the Cherries. It is a glorious Tree for Standards on most Grounds, but on our coldest and openest it holds out our hard Winters best: It may be kept with a clear stem two or three foot high, and let the Head be kept round, so that if you have a Row of them, the Trees all of a height and bigness, and the Heads all of a shape, no Tree is more pleasant: It is fit for Groves, Wildernesses, Hedges, &c. It will grow well on any ground, therefore make use of this beautifull Tree.

*The Oak at first doth like a King appear,
The Laurel now at last brings up the Rear:
The one does tender Plenty and Renown,
The other offers Pleasure and a Crown:
The Elm, the usefull Ash, and Sycomore,
Together with the Beech and many more,*

They

*They promise all content to those that look
To practise what is written in this Book,*

CHAP. XXX.

*General Rules for planting Forrest-trees in Avenues, Walks,
or Orchards, as in a Natural Ground.*

First as to the Ground, your Ground that hath been fed for many years, Winter and Summer, as your common Pasture-ground, or the like, such Ground (if it be any thing good) is the Best: The next is your Meadow-ground; and then your plowed Land, if your Land be of Soyl alike. Thus I preferre them. Several Reasons might be given for this, but I shall instance onely in these few:

As namely, your Ground that is constantly fed, hath likewise constantly a supply of Cattels Dung and Urine, with the variety of Kinds, which adds much to the strength of the ground: and likewise your Pasture-ground, though it abound with great variety of Herbs or Grass, according to the Nature of the Ground, as also your Meadow-ground doth; yet your Pasture-ground hath not only a constant supply of Soyl by one sort of Cattel or other, but the Grass which growes on it, doth seldom run to flower or seed; which when they doe, they draw forth much more of the Salt or Spirit or strength of the Earth, as we find the Herbs or Grass on Meadow-grounds most commonly doe. Therefore I judge your Commons the best; and both common Field Ground and Meadow better than constant plowed Land; for that being kept with plowing to prevent what naturally it would produce, this makes the Ground the Better; for 'tis certain, that where your Houses stand, or High-ways are, there the Earth is full of Salt and Spirit, or the Life of Plants; not only because there is often some Assistance of Soyl, which I confess makes it much Richer, but also because it cannot produce those Plants which naturally it would, were it not Restrained; For still it receives a constant supply from Nature, and as the Holy Scripture saith, *the Almighty causeth the Sun to shine on the Unjust as well as the Just*, so also hath the foresaid Earth the secret Influence of
the

the Heavens, as well as any other, unless Accidentally prevented ; but this by the way.

Now as for your plowed Land, 'tis granted to be much better for plowing ; but this being sown with Annual Grain, very much draweth out the strength of the Earth ; for I judge that your Annuals are much more drawing Plants than those which will last several years, it being in my Judgement with your Annual Plants, as it is with a man which hireth a House for a Year, when his year is out, he knowing he must remove, cleareth the House, especially of his own ; when as your Durable Vegetable, (like a man whose house is his own) is favourable to its situation, having a kind of secret Knowledge (as I may say) that there they and theirs may continue many years.

If this be understood, I hope you then will say with me, that your common Pasture is best to plant on ; next to that, Meadow, then plowed Land ; that is, if all three be of equal goodness and soyl.

C H A P. XXXI.

Of planting Forrest-trees to make Woods, or to fill up Naked places in Woods, where they want.

TO tell some men of planting of Woods, is very needless ; for there are too many men more inclined to stock up than to plant them ; but I suppose the greater sort of Men, and I am sure the best sort, are more inclined to preserve and plant, than to destroy and stock them up. To those then that love either their Countrey or themselves, or especially their Posterity, and have any kindness for stately Forrest-trees, do I give this Advice.

First, Let the Ground be of what Soyl soever, be sure to plant most of such Trees as will grow best on that Soyl ; As if it be Gravel, then Beech, Holly, Hesel, &c. if mixt with Loom, then Oak, Ash, or Elm, &c. if stiffe, then Ash, Hornbeam, Sycomore, &c. if a light Loom, then most sorts ; and withall, have an eye to the adjacent Trees, and which sort soever you see thrive best, be sure to furnish your Ground with store of them.

Secondly, If your Ground be moyst, then set in good store of the Cuttings of Alder, Willow, Sallow, especially the two last on any

N

Ground ;

Ground; for if there comes a wet Spring, or a moyst Summer, many of them will grow, and produce good under-wood, if set as is directed in the 26th. or 27th. Chapters. Though the Ground be drye, and a Gravel-Bottom, yet they will thrive and produce good shoots in a little time, as I have found true at *Cashibury*, &c.

Thirdly, If you be minded to sow seeds, then you must prepare your Ground with a good Tillage before you sow your seed, as much as you doe for sowing of Barley; and having all your Seeds ready prepared (by being kept some time in a House till they be fit to spear, or speared a little) then about the beginning of *February* sow them: The particular Chapter of each Kind will tell you how long it is before they will spear: If you plow your Ground into great Ridges, it will make the Earth lie the thicker on the top of each Ridge, and there the Roots will have the more depth to search for Nourishment, and the Furrowes will in little time be filled up with Leaves, which when rotten, will lead the Roots from one Ridge to another.

If your Ground be very drye, then plow your Ridges crosse the descent of the Hills, not to drayn the water off, but to keep it on your Ground; and if your Ground be very wet, then the contrary.

But be mindfull to sow most of those seeds your Ground is most naturally for. The most of these seeds following may be sown on your Ground: Oaks, Ash, Beech, Sycomore, Hornbeam, Crab or Apple, Cherry, Walnuts, Chesnuts, Holly, Hasel-nuts, Maple, Sarvice, &c. Which of these you find are not Natural for your Ground, neglect them. Some do sow their Seeds with a Crop of Barley, but the season of sowing of Barley is too late for your seeds, if they be prepared before-hand; but if you will be so saving as to have a Crop of that Tillage, then sow your seeds with Oats, for they may be sown with the season of your seeds: Do not sow your Oats too thick, and they may do well; but the best way for your seeds, is to sow them without any Crop of Corn.

Fourthly, If you are minded to have a Wood soon, then plant it with Setts, and if your Ground be a good Natural Ground for Trees, then you may make only holes two foot wide, and as much deep, and about half a Rod asunder, so there will be four holes in every Rod square. But for fear my Reader should be at a stand here, and ask me how four Trees may stand in a Rod square, or four holes made in a Rod square, and yet the Middles be each half a Rod, or eight foot and a half asunder, I shall here satisfie him by Example; and it shall be of a supposed piece of Ground three Rod square, you may make your holes square if you please. (*See Figure 1.*)

This

This is much like to that Question, Whether is half a Foot square, or half a square Foot, most? When as I have heard some say, they were both alike, but it was their Mistake.

For, $\frac{1}{2}$ a Foot square is only 6 Inches every way, that is, 6 times 6 is 36, and 6 times 36 is 216 Inches; when as half a square Foot is the half of a Cubical square foot, the number being 12 the square Root is 144, for 12 times 12 makes 144, and 12 times 144 makes 1728, the Cube, Now the half of 1728 is 864, which is half of a square Foot, then if you divide 864 by 216, you will find 4 for the Quotient, so that half a Foot square is but $\frac{1}{4}$ of half a square foot. This I have demonstrated as plain as I can, that I might be understood by every Countrey-capacity.

36
6
216
12
12
24
12
144
12
864
216
288
144
1728

Now if you were to plant one Acre of Ground after the aforefaid manner, the Charge would be as followeth: If it be a good digging ground, you may have 20 holes made for 12 d. two foot wide, and two foot deep; so there would be four times 160 holes, which is 640 holes, at 20 for 12 d. that is 32 s. and then I allow for every hole 2 Setts, so then it will take 1280 Setts, which will cost you together about 4 d. the 120. of any sorts of wood, which comes to about 3 s. 6 d. then for every hole 2 Sallow or Willow Cuttings 3 s. then 5 men to set them 6 s. and then Keyes and Seeds to sow among your Setts next Spring, 5 s. 6 d.

	l.	s.	d.
Making Holes	01	12	00
Setts	00	03	06
Sallow Truncheons	00	03	00
Mento set them	00	06	00
Keyes and Seed	00	05	06

Whole Charge 02 : 10 : 00

So that the Charge of one Acre of Ground planted this way, will cost you about 2 l. 10 s. where Work-men and Sets may be had at such a price; the Spring after, I advise to sow Acorns, Sycamore-Keyes, Apple and Crab-stampings, &c. Let this sowing be done so oft as you find

find Stampings and Keyes to be had, till you find your Wood very thick. I did sow all the Stampings of Apples and Crabs at *Cashibury* among our young Woods which I had set, and the Ground not producing a strong Grasse to choak them, they came up thick, and did well: But take care you let them not lye too thick long, for if you doe, the stampings will heat, and kill the Kernels; sow them therefore as soon as they be pressed, or else lay them thin, or keep them parted with dry straw.

But if your ground be bad, and a shallow Soyl, or that you would help an indifferent ground, and are willing to be at some more Charge to do it, then do thus, which in small time will pay you or yours well for your Charges.

Observe which is the Best way to lay out your ground, and then divide it into four yards distance at both ends, by little stakes, and make Rowes of stakes by setting up some few between the two at each end, which are only to direct you to lay your work straight, by plowing one yard of each side your Stakes: If your Ground be Greenforde, then plow it as is aforesaid, which will make the better for the Roots of your Trees to run in.

Thus having plowed two yards, and left two yards unplowed all over your Ground, a little before the season for planting, and when the season for setting is come, (that is, as soon as most of the Leaves are off,) having prepared Sets and Work-men, let them dig up the two yards that are unplow'd, laying one half of that Earth upon one of the plowed pieces, and the other half upon the other; and as you lay up that Earth upon the plowed pieces, there set your Setts about a yard one from another, with store of Sallow-Cuttings with them, digging that ground which you lay on your plow'd Ground a good spade-deep, and then it will be near a foot thick to set your Setts in. Thus goe from open (that is, unplow'd) to open, untill you have set all the plow'd pieces in your Ground: One man having the Setts ready, will set them as fast as four men shall dig, that is, two men on each side the Beds or Ridges, one a little before the other, so finish Bed after Bed till you have gone over and finished the whole Ground which you designed to plant that Winter; and endeavour to get all your planting done by the latter end of *January*, or beginning of *February*; for this Reason, that is, having provided Keyes, Nuts and Seeds, as is before directed, (and is in each particular Chapter more fully discoursed) about that time sow them, *Viz.* about the beginning of *February*, unless it be a Frosty season, for then you must stay a little longer; so sow
all

all your Beds over with seed, and cover them a little with the shovellings of some neighbouring Ditch.

In doing thus, you may be certain of a good thriving Wood in a little time, though the ground you plant on be (almost) never so bad. This I doe suppose to be as good a way as most are for planting of Woods.

Therefore, according to the Latine Proverb, *Serere ne dubites*, Doubt not to plant; and I wish I could perswade Noble-men and Gentlemen that have Ground that is not very good for Corn or Grasse, to plant it with Wood; especially in those Countreys where wood is scarce: I dare insure them, that it would be to them or their Successors a very great benefit, and also a great Ornament to their Naked Grounds.

Now I shall endeavour as near as I can, to give you an Accompt what the Charge of this may be; which, did I but know your Ground, and what wages your Work-men in such places have for one dayes work, I could then do more exactly.

But we will suppose the Ground to be a good digging Ground, that may be afforded to be digged and laid up for 4 *d.* the Rod-square, and our Example shall be of one Acre of Ground, of which you may well perceive by what is before shewed, there will be but one half plowed, and that half planted.

First then, for a good deep plowing of half an Acre of Ground 4 *s.*

Secondly, For half an Acre of Ground digging, at 4 *d.* 2 (2 the Rod, (for if 160 Rod make one Acre, then 80 Rod 80 (26 *s.* is half an Acre, and then 80 Groats for the digging,) comes 33 to 1 *l.* 6 *s.* 8 *d.*

Thirdly, If every Four men must have one man to set to them, then there must be near one fourth part more for him, which one fourth is 6 *s.* 8 *d.*

Fourthly, If we allow for every yard square in this half Acre, one good Set, besides Truncheons of Sallow and Willow, &c.

5^s--- the side of a Rod sq. is 5 yards and $\frac{1}{4}$.

5^s

275

275

30^s 25^s--- { The Number of yards in a superficial Rod square is 30 and $\frac{1}{4}$.

160--- The number of superficial sq. Rods in one Acre 160.00 y
 181500
 3025

4840.00 The number of sq. yards in one Acre, or 160 Rod, 4840.

Or if you would work this Question by the Line of Numbers, and your Compasses, set one point on one; Extend to 5 and $\frac{1}{2}$, the same will reach from 5 and $\frac{1}{2}$ to 30 and $\frac{1}{2}$.

Secondly, Extend your Compass from one to 30 and $\frac{1}{2}$, the same will reach from 160 to 4840: Thus you may prove your work by two turns of your Compasses.

(40 Now finding 4840 yards in one Acre of ground, and
 4840 (40 for every yard one Set, at 120 for 4 d. comes to Forty
 1220 Groats, and Forty over (which is 13 s. 5 d. 1 q. and $\frac{1}{2}$
 1 of q. for forty Groats is 13 s. 4 d.) then to know what
 the odde Forty come to, the Rule ranks it self thus: If
 120 cost 4 d. or 16 q. what then will 40 cost.

120 (13
 33

120 :	40		
	16 :	40	
	240	(40	1220 (3
	40	14	48
	640	(5	
640 :	120		

So you see that these 40 will cost 5 q. and 40 over, and if you divide this 120 by 40, there then will be 3 in the Quotient, which sheweth that 40 is $\frac{1}{3}$ of 120: So that 4840 Sets at 120 for 4 d. will cost thirteen Shillings five pence one farthing, and one third part of a farthing:

For Truncheons of Sallow and Willow 3 s. and for Seed 10 s.

	l.	s.	d.
Plowing	00 :	04 :	00
Digging	01 :	06 :	08
To a Man to set	00 :	06 :	08
For Sets	00 :	13 :	06
For Truncheons	00 :	03 :	00
For Keyes, Nuts and Seeds	00 :	10 :	00
Whole Charge is	03 :	03 :	10

Thus

Thus have I shewed some wayes for the planting of Woods, and also what Charge it will cost you, though I have spoke of the lowest Rates that good digging Ground can be done at; and where men work for 10 *d. per* day, yet if you love planting, and your Ground be a bad Ground to dig, (as a Gravel or stiffe Clay,) and that your Sets be scarce, or that you be minded to plant more in your Ground (which will be the better) then if you allow as much more to each Acre, the Charge may be computed accordingly, and you will find it not to be great.

There are more wayes to plant Woods, but these I take to be the best; or thus, instead of making your Holes Round, you may make them a long square, and the holes will be the easier to make after this way. (*See Fig. 2.*)

This that hath been said, I hope will be some satisfaction to those that love planting of Woods, and are to seek in the wayes; which if it be, I then shall be well satisfied, for my design is a General more than a Particular Good.

Now having finished your Wood, take care to keep it well fenced from Cattel of all sorts, and when it is about seven or eight years growth, then fell it, pruning up those to a head you are minded to leave for Standards, leaving half as many more as need to stand, for Timber-trees, as Oak, Ash, Elm, Beech, &c. selling the rest at the Ground, not flat off, but well sloped up; And if you have Popler, Abele, Cherry, Elm, Sarvice, &c. they will spring much from the Roots, and thicken your Woods; if not, set some in.

CHAP. XXXII.

Of planting Young Hedges, and how to improve and keep Old Hedges.

There are and may be made many sorts of Hedges of one particular sort of Wood alone, some for Ornament only, some for Ornament and Profit, and some for Ornament, Profit and a Fence. Juniper I take to be one of the best for to make a low Hedge, of any Plant or Tree we have growing in *England*; for it growes naturally very thick, is a slow grower, and hath alwayes a fine fresh green Colour,

Colour, and the severest of our hard Winters will not make it change his Countenance; I confess it is something ticklish to be Removed, for its being not used to stirre far from home makes it many times lose its way, and its Life too, if led far from its native place, at unseasonable times, or by an ignorant Guide, and put into such an Habitation as is not suitable for it to Live in. I have with good success removed it above Thirty miles, namely, from beyond *Cashibury* to *Little-Hadham*; there I made my Ground (notwithstanding it was naturally a stiffe Clay) by mixing it well with Gravel and Sand: I Removed it a little after *Bartholemewtide*, and I did not lose one Plant in ten, but they do flourish in two little Hedges most gallantly.

I shall not speak of that most healthfull Aromatick Seed which it beareth, nor of the use of this Cedar; but if you would be further satisfied, see Esquire *Evelins* Discourse of *Forrest-trees*, or any Herbal. I have not as yet raised any of it of Seed, but I am now making a tryal, which if they once come to endure Removing while young, I doubt not but then they will be better to Remove when old.

Holly makes a most stately and beautifull Hedge; and had we but store of the White-berried Holly to mix in the Hedge with the Red, it would make it the more Ornamental. Its Ground that it most delights to grow on, is, drye and gravelly: See more in the *Chapter* of Holly: Or had we but store of the strip't to make Hedges with, it would be very Noble indeed.

Hornbeam may be kept in a good shape for a high Hedge, and very thick, even to the ground. It is (alone) one of the very best home-bred natural Forrest trees that shed the Leaf, to make a Hedge of; and is fenceable, unless against the rudest sort of Cattel.

Box maketh a good Hedge, and lasting; I mean the *English*, though the others are pretty for Hedges, both the Gilded, and the Dwarf; but these two being not proper to name, or to discourse of among Forrest-trees: I shall only name them and many other sorts, and so pass forward.

Laurel, (as we call it,) or Bay-Cherry, makes a good Hedge, and if well kept, very fine Standards. Hard Winters do pierce it on some Grounds, but on most it is durable; it is easie to increase, and will grow well on most Grounds; Keep it but down, and it will grow strong below, and thick, and then make a very fine Hedge.

Arbutus, or Strawberry-tree is a Curious Plant for a Hedge, onely it is very tender, especially while young; for, the Leaves being constant whilest Life lasteth, and of a fair Green, finely dented about the Edges, and its pretty white Flower in Summer, with its Strawberry on,

on, the beginning of Winter, all together adde a great deal of grace to this Plant.

Cypress would make fine Hedges, but for two faults; for first, in some Grounds it is tender, and will not abide our hard Winters. And Secondly, it doth not love to be headed, for that makes it still more tender: Cut it not late in Summer.

Mezereon or *Dwarf-bay*, both the Red and White together make a pretty low Hedge, and shew very beautifully Early in the Spring.

Alaternus or Ever-green Privet makes a fine thick green hedge, it would be supported with a Frame, especially while 'tis young.

Pyracantha or prickly Corall makes a good thick Hedge, and a very fine shew when it is full of its fine Red berryes, which appear like Beads of Red Corall among the dark green Leaves. It likes our Entertainment so well, that it will grow well on most Grounds; our Winters disturb it not, and 'tis very easie to be multiplyed or increased by Laying or Cuttings.

They that have store of Ground, and are Lovers of Plants, I hope will not be without these few named, and many more that will be very acceptable; but they be not some of them so proper for Hedges: Many more there be that would make very fine Hedges for pleasure, if well kept, as the double-blossom Cherry, the *Laurus*, *Tinus* or wild Bay, Primme, Savin; &c.

These few are only for Ornament, and make (any of them) fine Hedges alone, or you may mix them with Judgement, and they will then be very pleasant.

Now I shall shew you a few of those that are for profit and Ornament; such are the Summer-Pears on Quince-stocks; for that makes them the more Dwarfish; Cherries make a fine Hedge, but especially the small-leaved, as the several sorts of *Flanders*, great Bearers, &c.

Plumbs, Quinces, Codlins, Barberries, &c. all these make fine Hedges, but must have Supporters: In the three last there is this fault, that the better they be kept, I mean the handsomer, the worse they will bear. But I am got too far into the Garden, and now I shall give you an Account of such as are proper to fence in your Woods, Orchards, &c. which is the scope of my Discourse; for such are both profitable and pleasant, though not so Ornamental as the other before; and if you would make a Fence of one particular sort of Wood, the very best is your White-bush, or White-thorn.

Your Crab-stocks make also a stout strong Fence; and if you leave at every twenty foot one to run up, keeping it with pruning till it is

five or six foot high, and then graft it with Red strakes or other good Syder-fruit, such a Hedge would be very pleasant and profitable: You may so order your Stock and Tree whilest they be young, that by pruning you may have the head of your Tree to hang into your Ground, a little over your Hedge: Let me desire you to make such a Hedge where you have occasion to make one: As for your Stocks they are as easie to raise as Barley, and they are as certain to grow on most sorts of Ground, as any one wood I know.

For common and publick Fences there is none to compare with these two, for certainty of growing, for a thick, strong, and an armed Fence.

Black-bush makes a good strong Fence, but it hath one Inconvenience, that is, it will not keep within its bounds, but will run very much into your ground, and there be very troublesome to keep out: Therefore if your Fence be for Wood, it may do well, for the Reason aforesaid: Also when you plash it, it will often be ready to die, by Reason that it shoots so much from the Root.

Thus have I shewed you some sorts of Woods to make your Hedges with, I shall now give you some Directions how to make them; and here observe that for all those which are for Ornament only: You must prepare a Border by good digging and clean picking it from weeds, adding some good Natural Earth, such as the Kinds you set do most naturally grow in, which let be well prepared against the season for planting, and then make use of your time: The greatest sort may be set about a yard one from another, such as your Holly, Laurel, &c. the other about two foot or less, such as your Juniper, Mezereon, &c. Let this be the most, but if you have store of Plants, set them thicker, be sparing in heading most sorts of Greens.

For those that are for Ornament and Profit, the Ground must be made good, trenched deep, and mixt well with Dung; they may be set about six foot asunder. You may make very curious Hedges of Pears, Cherries, &c. But I am too far got into the Orchard or Garden; I must retreat to my Forrest-trees, to shelter me from the Gardiners Anger.

Of those sorts that are for Ornament, Profit, and for Fence, I have told you that there are two peculiar sorts, viz. the White-thorn and the Crab; which are indeed the most proper to fence in our Forrest-trees, and woods, of any I know. I know most Hedges, which are mixed with many sorts of wood, are apt to come too fast, without planting Sets of White-thorn, which in most places are plentiful to be
had

had ; bur if you would Raife them of Haws, order them as is shewed of the Cherry or Yew-berries.

Now to Raife your Crab or Apple-stocks, (though the Crab-stocks are better than your Apple-stocks, for the Crab grows more rugged, strong, and is more lasting, but Stocks raised of Apple-kernels will do well) let your Ground be well prepared by Digging, and picking it clean from weeds ; mix it with some good rotten Dung, then when the time is, that they beat their Crabs for Verjuice, or Apples for Syder, then prepare your self with so many as you think are convenient for your Ground, and as soon as they be stamped, sow them if you can, for if they lie long in the Stampings, that will heat and spoyle your Kernels : Therefore if you have them to fetch far, or that you cannot sow them instantly, then let them be sifted from the body of the Apple, and spread thin, or mixed with drye Sand, till you have opportunity to sow them ; or you may keep them in Sand (the Kernels I mean) a little moyst, till *February*, and then sow them ; but be sure your Ground be well prepared before-hand with good tillage, and clean picking ; cover them about one Inch, or a little more, with fine Mould ; afterwards, when they come up, keep them constantly clean from weeds ; Remembring if you sow at *Michaelmas*, that you take care to keep Traps set, for fear Mice rob you of your Kernels. Thus may you Raife what Quantity of Stocks you please, which at two and three years old you may set where you would have them to stand, for to Raife Trees, or to make Hedges for fenceing in your Ground. Keep them clean from Weeds by Digging or Hoing.

Thus having shewed you how to furnish your selves with store of Stocks in a little time, which will make you as strong and good Fences as most wood whatsoever, and are very profitable too, both to yield good Liquor for Drink, and to bring good Fewel to the Fire ; I shall now shew you how to plant these Quicksets, both for Hedges with Ditches, and for Stant-hedges (as some call them) without Ditches.

First, Strain a Line where the inside of your Ditch must goe, next your Hedge, then mark along by the Line, sloping, as you would have the Bank of your Hedge to slope, then strain the Line on the other side of the Ditch, and mark it out sloping inward to the Ditch, as you did the other side : For Example, suppose you make your Ditch a yard at the top, and three spade or a yard deep, let it slope so on both sides that it may come to a foot wide at the bottom, but let the Hedge-side slope the most, then if your ground be Green-sward, and stiffe Land, with a Turing Iron take all the Turf off the breadth of your Ditch,

then cut out a Triangle-piece all along next the bank, turn hat spade down, for to make the slope of your bank; Lay some of the Turf you cut off, or all of it, on the back-side of that Triangle-piece; thereon set one Row of Quick, covering the Roots with Crumbs of Mould, the Ditch one yard, and the Bank a yard, as you may see in *Figure 3.* where A. is the Triangle-piece cut out of the Ditch, B. the piece laid on the Bank, with the Turf laid grass-side downward, and the Set on the top of that piece, then level up the Bank till it comes level with the top of the piece B. and then lay on such another Angular piece, and on the top of that a Quick-set, as the other, then level up as before, and set another Angular piece, with the Quick on the top; so have you three Rowes of Quick-set, which let stand about one foot from another in each Row, and if your Ground or the Bank be dry, set them a foot deep, and if you will you may set one row on the top of the Bank; but three Rowes set each against other, open, triangle, make an excellent Fence; if set as is aforesaid.

(See Fig. 3.)

And note, that the higher and larger you make your Bank, the better your Quick will grow; for this Paradox is true in planting, That the more you spend, the more you shall get; but if your Ground be a light Soyl, then you need not take off the Turf from the triangle-pieces, because the Turf will make such Ground hold up the Bank the better; but then it will grow out at the edge of the Angle, and so will trouble you the more to weed your Quick; and besides you will want it to lay in the midst of your Bank, which would feed your Sets much, and make them grow the better.

But if you would make a Stant-hedge without a Ditch, the usual way is, to dig a Trench about a foot and a half wide, therein set two or three Rows of Quick, which on good Land may prove indifferent well, but if your Ground be bad, or that you would make it grow and prosper well on any Land, then dig a place where your Hedge must stand one yard wide, and make a Bank with Earth one yard high, being one yard at the bottom, and narrowed by degrees to a foot at the top; set two Rows of Sets on each side this Bank, as is shewed before about planting the Bank by the Ditch; or you may make this Bank two foot wide below, and two foot high, setting one Row of Quick on each side, and one on the top, as is before directed; and ever observe, that the larger you make your Banks, the better your Sets will grow, as is before noted.

You may, if your Fence be near to an High-way, have Earth sufficient from thence to make this bank, which will be a little fence of it self,

self, and help the growth of your Sets much; or you may slope off your ground a foot deep by this Bank, and some ten foot off come out to the Level of the Ground; there may you furnish your self with Earth to make the Bank, plowing or digging up that ground where you took off the Earth, adding a little Dung to it, which you may sowe in the Spring with Corn or Hay-seed, and your Ground in little time will be never the worse, especially if the Soyl be good.

Thus having set your Hedge, cut off all the sets within one inch or two of the ground, and keep them weeded for two or three years; and when they have shot two years on good, or three years on indifferent ground, cut them off within three Inches of the ground; but if there be some places too thin, there lay down some into the gaps, and cover them and the rest over one Inch with Mould, leaving the Ends of the the Layers out, which will draw Root, and thicken your Hedge. Let this be practised at all times, when you make or lay your Hedges.

But note, if your Hedge be set with Crab, or Apple-stocks, that you leave one standing, uncut up, at every twenty foot, or at every ten or twelve foot, if the Ground be your own, on both sides the Hedge; then may you so order them, by pruning or staking, that one may lean into one ground, and the other into another, &c. Prune up these Stocks yearly, till you have got them out of Cattels reach, and then graft them with Red-strake Jennit-moyl, or what Syder, or other Fruit you please; but if your Stocks be of Apple-kernels, you may let them stand ungrafted, and they will yield you very good Syder-fruit; but Stocks ungrafted will be the longer before they bear, and also when you graft, you may be certain of your Kind, but if you find a very natural Stock, that is likely by Leaf, Shoot and Bud, try it; by so doing you may have a new fine Fruit: if you like it not, you may graft it when you please.

The rest of the Hedge when it hath shot three or four year, you may Lay, for to make a fence of it self; for you must mind to keep it from Cattell till it comes to be Laid, and one or two years after; And now to Lay it, I shall give some few Rules, which may direct you when you Lay any Fence-hedge, of what sort of wood soever it be.

First at every Laying, lay down some old Plashes, or young ones if your Hedge be thin; but let them point with their Ends to the Ditch-side of the Bank, keeping the ends low on the Bank; they will the better thicken the bottom of your Hedge, and keep up the Earth of your Bank.

Secondly,

Secondly, At every Laying lay Earth on your Bank, to heighten it, and to cover your Layers all but the Ends, which Earth will help your Quick much, and make the Fence the better by heightning the Banks, and deepning your Ditch.

Thirdly, Do not cut your Plashes too much, but just so much as they may well bend down; and do not lay them so upright as some of our Work-men doe, but lay them near to a Level, the Sap will break out at several places the better, and not run so much to the ends as it will when they lie much sloping. If you have Wood to spare, cut up most of those that grow near the Ditch; but hang the Bank then with Bushes, to keep the Cattel from cropping them the first year; these will shoot strong, and secure your Hedge well, keep up the Bank, and thicken the bottom of your Hedge, &c.

Fourthly, Lay your Hedge pretty thick, turning the beard on the Ditch-side; but do not let the beard hang uncut, as the common work-men do, (though it doth make a good shew at first making,) but cut off all the stragling boughs within half a foot of the Hedge on both sides, then will it shoot strong at these places, and thicken your Hedge much the more: Of this, Reason may inform you, as it did me, and Experience will afterwards confirm it.

Fifthly, If you have got a good high Bank, make your Hedge so low as you think it may but just serve for Fence the first year; for it will soon grow high, and the lower your Hedge is made, the Quick will grow the better, and the bottom will be the thicker; but take care to keep out Cattel from the Field-side, the first year after it is made.

Sixthly, If you would have a good Hedge for Fence, you must sell it often, doing as is aforesaid, and take care at every selling to root out Elder, Travellers Joy, (that is Bull-bine, as some call it,) Briar, &c. and also leave not too many high Standard-trees or Pollards in it; the Elm is one of the best. Doe not use too much dead wood in the bottom of your Hedges, for that choaks your Quick; but if you have a gap, make your dead Hedge at a distance. Much more I could say of Hedges, but I forbear.

Only I cannot pass by the Learned Esquires good Advice, in his Discourse of Forrest-trees, (pag. 50.) which is this: *I do only wish, upon the Prospect and Meditation of the Universal Benefit, that every person whatsoever, worth Ten Pounds per Annum, within his Majesties Dominions, were by some indispensable Statute obliged to plant his Hedge-rows with the best and most usefull kinds of them, especially in such places of the Nation, as be the more Inland Counties.* Thus far

far the Learned Author: To which I adde, that if they did not plant so many Trees, and keep such a number planted, they should be compell'd to plant ten Crab-stocks for the want of one Tree, &c.

If this were but as much in use with us as it in *Hereford-shire*, and once grown to a Custom, we should in few years banish out forraign Drinks by this our excellent and most wholsom one. Besides, our Trees in shallow ground would thrive better in Banks of Hedge-rows, than in the middle of the Ground.

Again, (saith he) Undoubtedly if this course were effectually taken, a very considerable part both of Meat and Drink which is spent in our prejudice, might be saved by the Countrey-people, even out of the Hedges; which would afford them not only the Pleasure and Profit of their delicious Fruit, but such abundance of Syder and Perry as should suffice them to drink of one of the most wholsom and excellent Beeverages in the World.

Old Gerrard did long since alleadge us an Example worthy to be pursued: I have seen (saith he, speaking of Apple-trees, lib. 3. ch. 101.) in the Pastures and Hedge-rows about the Grounds of a worshipful Gentleman, dwelling two miles from *Hereford*, called Mr. Roger Bodnome, so many Fruit-trees of all sorts, that the Servants drink for the most part no other Drink but that which is made of Apples; the Quantity being such, that (by the Report of the Gentleman himself) the Parson hath for Tythe many hogsheds of Syder. An Example doubtless to be followed of Gentlemen that have Lands: But Envy saith, The Poor will break down our Hedges, and we shall have the least part of the Fruit: However, I advise you to go forward, in the Name of God; Graft, set, plant, and nourish up Trees in every corner of your Ground; the Labour is small, the Cost is nothing, the Commodity is great, your selves shall have plenty, the Poor shall have somewhat in time of want to relieve their Necessity, and God shall reward your Minds and Diligence. Thus far honest Gerard.

And in truth, with how small Charge and with how great Pleasure this were to be effected, every one that is Patron of a little Nursery can easily calculate: But by this Expedient, many thousands of Acres, sow'd now with Barley, might be cultivated for Wheat, or converted into Pasture, to the increase of Corn and Cattel; besides the Timber which the Pear-tree doth afford, comparable for divers curious uses with most: this also would make Timber the more plentifull; the decaying Trees and pruning would be good Fire-wood.

One thing more I do wish were practised in our Hedges, and those fined severely that did not observe it, viz. That there should not an Oak in any Hedge whatsoever, be headed, but that the Owner might have

have liberty to shread them up as some do Elms, though not to stock or sell them till such an Age; in such Banks we should have the best Timber, and enrich the Owner, &c.

CHAP. XXXIII.

Of planting several sorts of Forrest-trees, in order to making the best advantage of Ground, as Orchards, or the like.

Suppose you were to plant one Acre of Ground, or more, with Walnuts or Chesnuts, or the like, and would have it planted to the best advantage; that is, to have your Trees stand in good Order to the Eye, and to have as many Trees as conveniently you can in your Ground, (which is supposed all men would have) and yet your Trees to stand at convenient distance.

Now (I say) supposing your Ground to be one Acre, and a Geometrical square, in such a ground you may begin your first Row on which side you please to stake out your Ground for the holes to be made; you must first resolve what distance your Trees had best be planted at; remembring, that if your ground be good, and a deep ground, then you may plant your Trees at somewhat the greater distance: Of the Ground that most Trees delight in, you may see in the particular Chapter, speaking of each Kind. Your Best way is to plant them Triangular and not square, as some doe; for you can plant them in no form or order whatsoever to be more pleasing to the most Noble Sense, than to have every three Trees to make an Equilateral Triangle; nor in no other way whatsoever to have so many Trees to stand in such, or any piece of Ground whatsoever, at such a distance. For satisfaction, and likewise to demonstrate it more fully, observe these two following Figures of the aforesaid piece of Ground, which is one Acre, and is a Geometrical Square.

But before I shew you a Draft, or you stake out your Ground for your holes to be made, first consider well these few Rules:

First, Observe the Distance that your Trees ought to be planted at; alwayes remembring, that if your Ground be good, and a deep Soyl, that then your Trees will hold the longer, and by consequence grow to the greater perfection, therefore plant at larger distance. As for

Exam-

Example, If I were to plant this Acre of Ground with Syder-Apples, (as for Instance, all red-strakes, which is an excellent Syder-Apple, and is likewise a great Bearer, and a Tree that doth not last very long,) my Ground being also a shallow Ground, I think of 22 foot asunder to plant these Trees at, or as neer that as the Ground will permit.

Then Secondly, I go round my Ground, and observing my Fence well, and finding no great Trees in it, I then resolve to set my Trees at six foot from my Fence, (but note, if there be great Trees in your Hedge that fences your Ground, then this is too nigh) then I set off six foot at one Corner of my Orchard, and six foot at the other Corner of the same side, which is the East side, then I set off six foot at one Corner of the West side, it matters not which, only that End which is the Levellest, is the best for Measuring: Having set these three stakes, I strain a Line from one stake to the other, on the East side; then I lay a square to this Line, removing it along the Line till I find the other End of the Square point exactly against the Stake on the west side; then laying a Line right square to that Line, till you come at the Stake on the West side, I then measure by this Line as many 22 foots as I can; noting how many times 22 foot I find, and what you find is over, or more than 11 foot, then make your distance the less, to make that up the equal distance for one Tree more: but if it be less than half the distance your Trees are to stand asunder, then add that which is under the 11 foot, to the number of Trees that be to stand asunder. Observe but this, and then you need not fear that your Trees will stand too far off on one side, and too near on the other, it being the same Charge to plant in good Order as at Random, as too many doe; nay many times less Charge; and how much more pleasing Order is, I leave them to judge to whom the great God of Order hath given a great delight to imitate him in his glorious works.

But as for this my piece of Ground, which I pitch on only for Example, viz. One Acre, and a Square, I must find the square Root of 160 Rod, or as near it as my Chain will give, and then subtract but the 12 foot out for the distance of the Trees from the Fence, and divide the Remainder by 22, the Quotient tells you how many Trees will stand in a Row; the over-measure subtracted from, or added to, as your Reason teacheth you.

Note this, that it is most commonly the best way for your Rows to go the longest way of your Ground; for though your Trees stand 22 foot asunder, yet your Rows in their straight Lines will not stand so far.

Now to find the square Root there are very many Rules, but none
P that

that are to my Apprehension so exact and easie as by Logarithmes: find but the Logarithme of your Number, then take half that Log. the Number answering is the square Root.

Exam. The Log. of 160, is $2^{\circ} 20411998$.

The half of this Log. is $1^{\circ} 10205999$.

The nearest Number answering this Logarithme is 12 Rod, $\frac{65}{100}$ that is, 12 Rod 65 Links of a one Pole-Chain divided into 100 parts.

The Proof may appear by these three Examples following.

Ex. as $12^{\circ} 65$:
by $12^{\circ} 65$:

6325
7590
2530
1265

160^o 0225

Ex. as $12^{\circ} 64$:
by $12^{\circ} 64$:

5056
7584
2528
1264

159^o 7696.

Ex. by Log. $12^{\circ} 65$ is $1^{\circ} 1020905$
Log. $12^{\circ} 65$ is $1^{\circ} 1020905$

The Number that
answersthis Log.
is 160^o 02.

By this it doth plainly appear, that $12^{\circ} 65$ is the nearest Number that can be found by your Decimal Chain it is but $\frac{1}{100}$ more, and by Logarithmes but 2 of a Link put into 100 parts, therefore exact as need be for this purpose, unless it were for Calculation in Astronomy, or the like. And you see that $12^{\circ} 64$ multiplyed in it self, amounts to 159 Rod and $\frac{7696}{100}$: so that I take 12 Rod and 65 of 100 to be Length or Breadth; it being a Square they both be as one.

Now being the Question is propounded in Feet, we must turn this 12 Rod and $\frac{65}{100}$ into feet also; but note, you may work the same by the Links of your Chain better than by foot Measure; but some ('tis possible) have not a Chain, therefore observe both wayes, and first by Foot measure.

12 Rod multiplyed by 16 Foot and a half, shew the Feet in 12 Rod.

As *Ex.* $16^{\circ} 5$ gives 198 foot:

12

330
165
198^o 0

Then for the 65 Links of one Rod, put into 100 parts, or if it be your four Pole-Chain (as is most usual now) put into 100 Links; then are these 65 Links but 16 Links and a $\frac{1}{2}$, by that Chain; then

(107)

then by the Rule of Three, say, if 25 (the Links in one Rod) be equal to 16 foot and a half (the feet in one Rod,) how many feet are equal to 16 Links and a Quarter?

The Question ranks it self thus in Decimal Fractions.

As 25 is to 16' 50, so is 16' 25 : to 10 foot $\frac{725}{1000}$ of a foot.

16' 50	
16' 25	x
-----	xx
8250	x46x
3300	x68' x255 (10' 725
9900	255555
1650	xxxx

268' 1250	

Do you desire to know what this Fraction $\frac{725}{1000}$ is, in Inches or Barley-Corns, (which be the lowest vulgar terms in surveying) to satisfy you and also my self, and likewise to instruct those that desire to learn this Excellent Rule, the Rule of Three, which rightly (for its excellent Use) is called the Golden Rule.

Observe this, if one foot, or 12 Inches be put into 1000 parts, as here it is, (and must be, being 'tis the Integer or whole summe of 725,) the Rule orders it self thus, as 1000 is to 12 Inches, so is 725 to 8 Inches $\frac{700}{1000}$.

725	
12	(700
-----	8700 (8
1450	1000
725	

8700	

Now to know what this $\frac{700}{1000}$ is in Barley-Corns, do as before, say thus, If 1000 be equal to 3 Barley-Corns, what is 700 equal unto? I say as here you see it proved, that 700 is equal to two Barley-corns and one tenth part of one, for 100 is one tenth of 1000.

700	
3	x100 (2
-----	x000
2100	

P 2

By

By this it doth plainly appear, that if 12 Rod $\frac{6}{8}$ be turned into feet, it maketh 208 foot, 8 Inches, 2 Barley-corns, and one tenth of a Barley-corn: So that you see the square Root of an Acre is near 208 foot 8 Inches two Barley-corns, neglecting $\frac{1}{10}$, because $\frac{6}{8}$ is somewhat too much. Now from this 208 foot 8 Inches, I take the 12 foot for the Trees to stand off from the Fence, there remains 196 foot 8 inches, then I divide this by 22, the distance the Trees are to stand afunder;

So I find there may stand ten Trees. for here you see there
 $\begin{array}{r} 2 \text{ (20)} \\ 196 \text{ (8)} \\ \hline 22 \end{array}$ may be open places, and 20 foot 8 inches for one more;
 so there wants but one foot 4 Inches (or 16 Inches) to
 make 10 Trees in a Row, for there is alwayes a Tree
 more than the open.

Note, that in planting of Walks, this is of good use,
 22 foot: 0 : that (as I said before) to make one Tree more, this
 20 foot: 8 in: 16 inches I divide by 9, (being there are 9 opens be-
 tween the ten Trees,) the Quotient is near 2 Inches,
 01 foot: 4 in: which subtract from 22 foot, and there remains then
 21 foot 10 Inches, and so much must every Tree stand afunder, the
 proof is as followeth:

$$\begin{array}{r}
 21 \text{ foot: } 10 \text{ inches:} \quad 189 \\
 \underline{9} \quad \quad \underline{9 \text{ (6 in:)}} \quad \quad \underline{7} \\
 189 \quad \quad 920 \text{ (7 foot:)} \quad 196 \text{ foot:} \\
 \quad \quad \quad 12
 \end{array}$$

Here you see that 'tis 196 foot and 6 Inches, it wants but 2 In.

Then to know what distance your Rows may stand afunder, the Rule is, If you make an Equilateral Triangle, the perpendicular of that is the distance between the Rows, which Triangle I have drawn by the same scale of the Orchard. (See Fig. 4.)

See Chapter the 44th. The breadth of my Paper
 $\begin{array}{r} 245 \text{ (2)} \\ 196 \text{ (66)} \text{ (32)} \text{ 79} \\ \hline 196 \text{ (66)} \end{array}$ 6 inches, the Plat 196 foot, and 66 of 100 for the
 8 inches, my Scale is near 33 parts in one inch, but
 I take 32 because it is an even number.

(See Fig. 4.)

If you will trye the Perpendicular of this Triangle, 'tis but 19 foot, so that there are 3 foot between every 2 Rows saved by Planting your ground this way, more than those that plant their Ground to have every 4 Trees to make a Square, the Trees standing in both at the same distance.

But finding that but little Paper beareth the full breadth of 6 inches the

the quarter of a sheet, and this being less square by twelve foot than my full Draught should be, this being only for the square of the Trees, I draw and proportion my Scale to the breadth of 5 Inches and a half: 208 foot divided by 5 and $\frac{1}{2}$, sheweth that your Scale must be one Inch divided into 37 parts, and better; but for fear this Scale should be too great, I draw my Plat by the Scale of 40 in one Inch, so if you divide 208 (the breadth of the Ground) by 40, it gives 5 Inches and $\frac{8}{10}$, and so broad must the Plat be, as you may see by the Figure: Thus may you enlarge your Draught, or diminish it on your Paper, as your pleasure is: But 'tis better to draw all your Draughts as large as your Paper will give you leave; the distance of the Trees in the Draught is 21 foot 10 Inches asunder. (See Fig. 5.)

$$\begin{array}{r} 4^{\frac{8}{10}} \quad (15 \\ 208 \div 40 \quad (37 \\ \hline 5 \quad 5 \end{array}$$

By this you see, that if you plant your Trees triangle, this Acre of Ground hath 11 Rowes and 104 Trees; but if you begin either side with 10, as before I began with 9, then will there be in this ground 105 Trees; but to know how many Rowes you may have in any ground, doe thus, and you may presently satisfie your self; you see the ground from one out-side Row to the other, is 196 foot 8 Inches, which divided by 19 (the distance that the Rowes be asunder, neglecting the Fraction as needless now) gives 10 distances. Always remember that there is one Rowe, or in a Range of Trees one more than the Distances, in this Draught the Trees stand at the same distance, but square.

$$\begin{array}{r} 196 \quad (10 \\ 19 \overline{)196} \\ \hline \end{array}$$

(See Fig. 6.)

By this last Draught it appeareth, that if you set the Trees at the same distance, and set them square, that then there will be but 9 Rowes and 90 Trees in this square Acre of Ground; but if you plant them Triangle, then will it hold 14 or 15 Trees more: But if your Plat of Ground be a long square, or any other Irregular Figure, then will your Triangle-way hold a great many more, in proportion to the Quantity of Ground; besides it makes many more Rowes, therefore more pleasing to the Eye.

Note this well for setting your Trees exactly, having found the distance they are to stand asunder, and likewise how many Rows, with a Line laid, or stakes true set, where your first Row must goe; the said stakes will be of good use to set the Trees by when your holes be made; having resolved on which side you will begin, which alwayes let be the side you find most in sight, set down your two Corner-stakes for the first and last holes to be made, then with your

Assistants

Assistants measure exactly in your Row by the Line 21 foot and Ten inches, but in case there should be odde measure, then proportion it (as is shewed before) by making one Hole more or less, as you see cause: Then having two men to assist you, with a Chain (for Line will reach or shrink,) measure exactly the distance of two Trees, let one hold at one Tree, and one at the next in the Row, you standing at the Angle, with the Chain equally stiffe, put down a stake at the Angle, and so go on to the next two Trees, pitching down your stakes perpendicular: And also considering the Thickness of your Stakes; thence let your two men go to the next, and you setting down one at the Angle, till you have staked out the whole Ground; this doe when you come to set your Trees, being carefull to keep your Chain strained both sides alike, and to allow for the crookedness of your Trees, and when you have got two Rows planted, then your Eye will assist you well enough to observe the Rowes as you go on.

Note also, that if your Ground be large, and a square, then your best way will be to find the middle Row, and set that off square from that side of your Ground you mind most, or find to be straightest; there begin to mark out your holes, and also to plant your Trees; but if your Ground be Irregular, or have an Angle on one side, then begin on your straight side, and run the odde measure into the Angle, as far as is convenient to plant in such a Ground, you need but find what distance your first Row must be set at: But if your Ground have both the sides straight, then it will be convenient to set the side-rowes at equal distance from your Fence; Thus you may well perceive, that it is but measuring the length and breadth of your Ground, and proportion one to the distance your Trees be to stand at, the other to the distance the Rows are to be asunder, and you may proceed to stake out your Ground. After this method you may plant any sort of Forrest trees in Groves.

The best way is, to stake out your whole Ground before you plant a Tree, or make one hole; by so doing you may well perceive where a fault is, and easily mend it in time (though some are of opinion otherwise,) but I shall leave them to their own Judgement, and satisfie my self with Experience and Reason: But for fear any thing should be dubious to you that I have writ, observe but the setting out of these two Rows, and then I hope it will be plainly demonstrated to you how to proceed. Suppose the Length of your Ground should be the length of the Line marked at the End thus ☉.

(See Figure 7.)

Having staked out your first Row, as before is shewed, and having the Chain exactly the distance of two Opens, then bid one of your men take one End, and the other man the other End, you holding exactly the Middle, bid one hold at the stake one, the other at the stake two, then pitch you down your stake right at the Angles, as the prick-ed Line sheweth: So let your two men remove from stake to stake, and you from Angle to Angle, till you have staked out your Rowe, and then let them come to that Row you last set out, and goe on to another, so proceed till you have staked out your whole Ground. Thus much for planting Trees in Orchard fashion. I have been the larger to shew the best way for improving your Ground, presuming, that every man that fenceth in a ground would plant as many Trees as he can in it; let such but mind what I have delivered, and what I shall deliver in the next Chapter, I hope it will be satisfactory to him; if it be, it will be the like to me.

But what Order soever you plant your Trees in, make your holes good before: Set not your Trees too deep, and keep them staked the first year, covering the ground over the Roots with some Litter, or Dung, and over that a little Mould, to keep the Sun from burning the Dung, and exhausting the strength. In the Spring walk over the Ground you planted in Winter, and set your Trees to right, and tread the Mould to the Roots, especially if the Spring be drye; keep all the cracks filled with Mould; after your Trees be set, keep your ground with digging or plowing, for three or four years at first, but the longer the better; your Trees will run and thrive in the loose Ground much; but if you do not so much mind Order in Planting, but would keep your Land for Corn, and yet would gladly have Fruit-trees too (which may very well be, and you may have good store of Fruit, and not much the less Corn,) then plant your Rows about thirty foot asunder, the longest wayes of your Ground, and set the Trees in the Rows about 15 foot asunder, and let the Trees in each Row stand exactly square; so may you have a very fine Orchard, and little or nothing the less Corn: Many years may you have as much Fruit as is worth a good Crop of Corn, off so much Land, and not the less Corn; which may well encourage you to planting, if you dare believe me; but if not, be but so kind to your self and me, as to trye whether I tell truth not. Be sure to keep Cows out of your young Orchards; Sheep will do no harm, provided you wispe your Trees about with Thum-bands whilest young, which is the best way to keep them from the destructive Hares and Coneys.

CHAP. XXXIV.

Of Pruning Trees, some general Observations.

Although I have shewed you how to prune most sort of Trees, in each Chapter, where I shewed you how to raise them, yet I shall say a little more; and all will be too little; for the Curate of *Henonville* tells you in his Book of the *Manner of Ordering Fruit-trees*, That it is a Thing very rare among Gardners to Prune Trees well; for the doing of it well depends more upon their Ingenuity than upon their Hand: It is also very hard to give Instructions for it, because it consists not in certain and general Maxims, but varies according to the particular Circumstances of each Tree, so that it depends absolutely upon the Gardners Prudence, who ought of himself to judge what Branches must be left, and which are fit to be cut away, &c.

Indeed that erroneous Custome and Saying (which is among most men) of Timber-trees, not to prune them at all, or if you doe, to cut off the boughs at distance from the Body, hath made many a good Fruit-tree lose its life sooner by many years than it would have done, and also hath yielded to the Owner much less and worse Fruit than it would have done: Therefore whatsoever Bough you cut off from Fruit or Forrest-tree, cut it close and smooth, and the lowest side closest, then will it not hold water, and every year the Bark will surround and overgrow the wound by little and little, till it hath quite healed the place; But if you leave a Stump, it's likely that will hold water, and make a hole into the very Body of your Tree, and so in little time make it sick and kill it, which before would bear you but little and poor Fruit: Or if the Stump hang down so that it doth not hold wet, then the Tree must be as big as that Stump is long, on all sides, before it can over-grow that place; or if the Stump rots, and breaks off, then many times it leaves a hole in the Tree, which if it tends much upward, so that it takes water, it certainly kill's the Tree; and if the Tree be not a very thriving Tree, it will be very long before it overgrows that hole, though it do not take wet: Therefore what
boughs

boughs you cut off, cut them off close, unless the Tree be very old, and the boughs great, such I do not advise you to meddle with; but if you doe, cut them at a distance from the Body, alwayes remembering to let the wound be smooth, and to tend as much from the Horizon as may be. All boughs that grow upright, be they great or little, cut them not right cros over, but cut them sloping upward, and let the slope aspect the South, East or West, if it may be; and in those boughs that lean from the head, cut the slope on the lower side, the slope tending downward, so will they cover over the better; if the wound be great cover it over with some Clay, well mixed with Horse-dung to keep it from the weather, and it will cover over the sooner.

Many a good Tree is spoyled by grafting of it in bad places, as I have seen in some hundreds, of which I have not spared (as oft as I could) to tell the Owners, but few would believe me; for sometimes they cut off great boughs, till they come to 6 Inches (or thereabouts) Diameter; there they put in four or six Grafts in the Bark, and sometimes two in the Clift, and saw the bough right cros over, though it grow upright, in which if the Grafts do grow, the head is so great, and they growing Round (as it were endeavouring to cover over the wound) make such a hollow place (like a Dish) on the Head, as holds water and kills the Tree, which is many times dead before the Grafts can cover over the head: or if the Tree doth not thrive very well, they keep that place well covered with Loom, or Clay mixed with Horse-dung, and sometimes they head the Tree very low, and thereby check it so much, that it dyes in little time after: Sometimes they cut off such great boughs, and do it so ill, that though the heads grow, yet in little time these wounds kill the Tree. Though I shall not here teach you how to graft, yet let me advise you when you graft high great Trees, not to cut them too low, but to prune them up till they come to the thickness of your Arm, or less, and then graft them, for then will the Grafts soon overgrow such places.

Leave a good many of these Heads on, according to the bigness of your Tree, that if some miss you may take them off the next Spring, and yet have enough for the Head. If you graft in the Bark, you must remember to head your Grafts about *Midsummer*, or else they will be subject to blow off; put your Grafts in alway on the upper side, and cut upright Boughs a little sloping off, they will heal over the better; keep them from Suckers, and then you may expect good Trees and Fruit, of which I wish your Hedge-rows were full.

Of all sorts of Trees whatsoever, if any Roots be broke or much
Q bruised,

bruised, or cracked, cut them off till you come to firm Wood, the slope tending to the Ground like a Horse-foot; but be very sparing in cutting the Roots of Greens, and also in cutting their heads off, yet you may proportion the Head to the Root, by cutting off some side-boughs, which cut off (if your Green be tender) the latter end of *March*, or in *April*, and cut the Bough off two or three Inches from the Body, and that time come Twelve month take off that piece close, and cover the wound with a little Wax or Clay well tempered: if your Greens be for high Trees, endeavour to make them taper, by leaving some side-boughs to ease the head.

In all Trees you intend for Timber, be cautious in cutting off their heads, especially those of great Piths, such as the Ash, Walnut, &c. Unless your Tree grow top-heavy, or much crooked, and then at the crooked place cut off the head sloping upward, and nurse up one of the principal shoots to be the leading Shoot, but such as are subject to die when headed, or any Tree very great, meddle not with such; the Beech is one of the worst to head of any Tree I know.

Such Trees as you intend for to grow to a certain proposed height, you must take care to keep them taper, by leaving side-boughs in convenient place and distance to make them taper, cutting such boughs off when you find your Tree is swelled enough below; still minding to take off the greatest side boughs and leave little ones, and to proportion your head (by keeping it small) according to the Body, and maintaining the leading Shoot, letting it have no equals; for forked Trees are never straight: Thus do till you have got your Tree to the height you intend, and there let the Head break out, and cut off all the side-boughs, but if side-boughs still break out, then give them a Summer-pruning, a little after *Midsummer*, and cut them off close; so will you kill them, and have a fine, stately, clear Body, and fine Timber-tree: See *Chap. 10.*

Observe this in all Trees you would have grow with a handsome straight body, till you have got them to the height you intend they shall head at.

Whilst your Trees be small you must prune them every year: The best time for most is the Spring; but hardy Trees and Wood may be pruned at any time in Winter; when they be a little older, once in two year, then once in three, and then in four, and never seldomer than once in five or six, so will the Bough be small, the Tree will soon overgrow the place, the Knot will not be great to vex the Carpenter or Joyner at all, the place will not be very subject to put forth Suckers, because the Sap hath had no great recourse to that place.

Mind

Mind alwayes to cut off your Boughs smooth, and close to the Body: This if you please to doe, you may have fine Timber, and handfom Trees, which I dare engage will pay you or yours well for your helps to them.

The like doe with your standard Fruit-trees, or those you intend for Pollards, till you have got them to the height you design they shall head at, and at setting if they be tender Trees, or Trees that have great Pith. If you must head them, let it be in the Spring, when you find they begin to bud, but then you must take care of the winds in Winter, that they shake them not so as to let the Air in to the ground, to kill the Roots, therefore tie them to good Stocks.

Or this is a good way for Trees that have not great Piths; or are very tender; cut off some of the tops of the Boughs when you set them, so let them be till the Spring, and when you see the Bud break out, then cut them on every shoot of the head, a little above the lowest Bud or two of each shoot; so will the head shoot but with few shoots, and they will be the stronger; the head being small, the Root will endeavour to proportion it to its former greatness, or near it: but if you have many shoots break out, then cut them all off but four or five, for so many are enough to make Arms for any Tree; but if then you find the Tree to shoot too much, and grow top-heavy (as sometimes they will if well kept and on good ground,) then head the Tree again, but not so low as you did before, (for Reason ought to be used in all things; this will make your Tree swell in body much, and in time be a fine Tree: So that I say, endeavour to get a good Body; for in Fruit-trees this is to be noted, that you must in the first place endeavour to get your Tree in such a Condition as to bear you good Fruit, and a Quantity, rather than little Fruit early, and then never good Fruit or Tree after; therefore if you have a Tree that doth not thrive, but is subje& to blow much (as most such Trees are) cut off the blowing Buds in the Spring, as low to a Leafie Bud as you can, and some shoots, as near the place where the Tree headed as you can; but mind to leave some Buds on the head to draw up the Sap, or else your Tree may break out in the middle of the Body, or a little above Ground; but if your Buds once shoot on the head, but half a foot, then will your Tree come away. Thus and by digging about, have I helped many a stunted Tree forward, which you may doe likewise, if you please.

I have many times observed several Fruit-trees, as Pears, Apples, &c. to be full of false-bearing Buds; I call them so because they did not blow, for the Tree having got more head than the Roots could well

maintain, had not strength sufficient to spare sap for blossom, nor yet for Fruit; which by pruning and thinning the heads of such Trees, and by slitting the bark on the Body in the Spring, hath made them afterwards to bear well, when they have put forth new shoots at the head.

And some sorts of Fruit-trees there be which will blow and bear themselves to death, when they be middle-aged, as before I told you some young ones would, if not helped by pruning; but the best wayes to preserve such Trees from death, and to make them bear pretty good Fruit, is, to cut off most of the blowing Buds, and to thin the head of some boughs, to make it shoot again; then will it live many years longer, and bear better Fruit: Some Trees there be that will run so much into wood, that they will not bear of themselves till they come to be old, but if you cut off the head of the shoots as soon as ever the Spring-shoot is over, which is near *Midsummer*, and take out some great boughs then; if you mind your Time, and do it with discretion, you may force that Tree to put forth blowing Buds, and blow and bear the year following.

Thus have I shewed you some wayes and hints of pruning Trees, though I know some that are against Pruning them at all; So are there some that are against Learning: but 'tis convenient for Trees to be pruned well, as also it is very necessary for men to be brought up in Learning; for thereby both produce much the better Fruits: therefore,

*Be gone from hence thou knotty-natur'd Turk,
There's nought design'd for thee within this work,
This was for Christians made, and such as be
Lovers of Trees and Ingenuity;
This was intended onely for the wise,
And none but Ignorants will it despise;
Let fools laugh on, and wise men plant as fast,
And see who'l have the better on't at last.*

I shall here shew you what the good Esquire saith in his Discourse of Forrest-trees, pag. 74. which he quotes from an ancient Author.

'Tis a misery (saith he) to see how our fairest Trees are defac'd by unskilfull Wood-men, and mischievous Borderers, who go alwayes arm'd with short Hand-bills, hacking and chopping off all that comes in their way; by which our Trees are made full of Knots, Boils and Cankers, to their utter destruction: Good Husbands should be ashamed of it: As much to be reprehended are those who either begin this work at unseasonable times, or so maim the poor Branches, that either out of laziness

ness or want of skill, they leave most of them Stubs; and instead of cutting the Arms and Branches close to the Boll, hack them off a foot or two from the Body of the Tree; by which Means they become low and rotten, and are as so many Conduits to receive Rain and the weather, which perishes them to the very head, deforming the whole Tree with many ugly Botches, which shorten its Life, and utterly mangle the Tree.

By this Animal version alone it were easie for an ingenious man to understand how Trees are to be govern'd, which is (in a word or two) by cutting clean smooth and close, making the stroke upward, and with a sharp Chizel or Bill, so as the weight of an untractable bough do not splice, and carry the Bark with it, which is both dangerous and unsightly; and by endeavouring to keep the Tree taper, by leaving some little Boughs on the sides.

I have here shewed you how to prune Forrest-trees, with somewhat of high Standard Fruit-trees; but if you would see more Books, then see Esquire *Evelyns Discourse of Forrest-trees*, and for Fruit-trees, the Curate of *Henonville's* Book.

But here note, if you should have any Trees that should be stundied, or very crooked, or much cropped by Cattel; the best way is not to stand to prune up such Trees to a Head, but first to fell them close at the Ground, and then they will put forth young straight shoots; one of the best you must nurse up, if you intend it for a Timber-Tree; if for under-wood, then let them grow with all the heads the Roots will put forth: The Spring is the best season for this. And thus much at present of pruning Forrest-trees; for I tell you there are more Trees spoyled by bad Lopping or Pruning, or for want of good Lopping or Pruning, than there are of all Diseases belonging to Forrest-trees, unless they be accidental, as spoyl'd by Cattel, &c.

CHAP. XXXV.

Of the Diseases of Trees.

THere be several Diseases and Casualties that do spoyl Trees, which sometimes happen in the Roots, and sometimes in the Body or Head.

1. The Roots may be the decay of the Tree; as, if they stand in Ground

Ground contrary to its Kind, as the Beech on cold Clay, and wet Ground, or the Alder on sharp dry Gravel, &c. which is contrary to each Kind, and must not thus be set.

2. It is also a great fault to the Roots of Trees, to set those Trees which naturally love to run shallow, too deep; or indeed any other.

3. When Ground is very stiffe or Rocky, it must be digged or plowed to make way for the Roots to run in, and contrary Earth layd round about the Trees Roots.

4. Great weeds must not grow round the Tree, for they will rob the Roots of their Nourishment; also they must early be weeded from Seedlings, or small Plants, lest they choak them.

5. Ivy, and Travellers Joy, Bryany, and such Climbers, must be pull'd up round your Trees, lest they pinch or make them crooked, and so spoyl them.

6. Suckers must carefully be pull'd off, whensoever you see them break out, opening the Earth, so that you may well come at the place of the Root where they grow out, and then pull or cut them off close: If you find them rooted, you may set them again, but then you must observe Winter-season; but such Trees as yield Suckers from the running Roots, as the Elm, Cherry, &c. if it be in Woods, and they thin, leave some of them as you please, they will do the Tree no harm; be sure to take suckers clean off from the Body the first year.

7. The Bodies are most commonly in danger, if Deer, Hares, or Connyes can come at them whilst they be young; therefore if you plant where Deer or Connies are, you must take care to fence them well with Frames of wood, and look to keep them so, or else never plant at all; for in one day or night they will bark round several, especially the Ash, Line, Abele, Poplar, &c. And take great care to keep your App'es and Pears from Hares and Connies in hard Winters, for they will spoyl them all if they come at them. The best fence to secure your Trees from them, is to tie Thum-bands of Hay or Straw round them, so high as they can reach; keep this renewed early every Winter.

8. Great Boughs ill taken off, as I have many times said before, spoys many a Tree; therefore take them off close and smooth, and not parallel to the Horizon: Cover the wound with Loom, or Clay, well mixed with Horse-dung, and keep it so covered; for if the wet fall perpendicular on such a place, it will in little time make the whole Tree hollow, by the wet getting in there, which comes by great Lops and bad Lopping; as you may see in too many Elms, Althes, Horn-beams, &c. spoyl'd by such carelesness.

9. If a Tree be Bark-bound, then slit through the Bark with your knife, from the head to the Ground: The Spring is the best season; This will do most Trees good, and no harm to any.

10. If Worms be got between the Bark and the body of your Tree, they must be cut out; and the place done over with Loom.

11. Cankered places, or gall'd, or boughs broke, are to be cut smooth, and covered over with Loom; the Canker must be cast clean out: If a great bough be broke, and the Tree old, cut it off at a distance from the Body, but little boughs close.

12. If a Tree be blasted in part, or the whole head, cut all that is blasted or dead close off to the Quick, and take out all dead boughs: Keep Caterpillars from the heads of young Trees, lest they eat off the Leaves and Buds, and kill your Tree.

13. Take care to destroy Moles and Mice, by Traps or Poyson; for Moles will make hollow the Ground, and much harm your young Trees: Mice will eat all the Bark off round the Body in hard Winters, and kill your Tree; but mind you in time to prevent them.

14. Rooks do destroy many a Tree, both old and young, before their time: As to old Trees by pinching off the tops, and breaking off the Buds; and young Trees by lighting on their heads; their weight breaking off their young tender shoots and Buds, causes the Trees to die; and also they destroy Seedlings where they breed; their Dung brings forth great weeds, as Nettles, &c. and so choaks the young Seedlings; therefore kill all of them you can at breeding-time, by shooting them, and setting Lime-twips on the tops of your young Trees: You'll thrive the better if you destroy them.

CHAP. XXXVI.

Of Felling and Ordering Woods and Coppices.

IF you love to have a thriving Wood, and to improve it for your best Advantage, your best way is, not to let it stand too long before you fell; for the oftener you fell your under-wood, the thicker it will be; as at ten or twelve years growth on a shallow ground, and twelve or fourteen years growth on your deep Soyl and best grounds; for there
be

be many Inconveniencies in letting your Woods stand too long before you sell them, or Trees in Woods that do not prosper.

First, When you let your Woods or Coppices stand long before you sell them, you cannot come to survey your Timber-trees, to see which be decaying, and in so doing you are uncharitable to your Country, no good Common-wealthsman, no good Husband for your self, and no good Christian: For why should any Reasonable man let his Trees stand in his Woods, or elsewhere, with dead tops, hollow Trunks, Limbs falling down upon others and spoiling them, dropping upon young Seedlings under it, and killing them? The ill husband, while many of his Neighbours want such Timber (nay possibly he himself,) there he lets his Trees stand, which were formerly worth 10 or 5 *l.* a Tree, or more, till they be not worth the half that they were: Here he loseth the use of his Money, more than Twenty in the Hundred, if it be an Oak, he loses the Bark, with the use of the Ground, where tis likely several young Trees might have been, if that had been taken down in time.

I know that some persons of Quality say, that this is a great Ornament to their Ground: But I think no greater than it would be to their persons to wear a Garment very Old, with half a skirt, a piece of a Sleeve, and all the Trimming off. But I shall never pronounce such Judgement against trees, having ten times more Mercy. Such as be thriving (unless they stand too thick) I would intreat you not to cut down; for you do not lose so much by suffering the Tree that is decaying, to stand; but you hinder you or yours as much in cutting down a young thriving Tree.

There are too many men in this Kingdom, who before they sell their Estates will many times sell off all their Timber that was good, and which would have thriven well for many years, and so by the Moneys they make of that, they lengthen out the time before they sell. I wish that my Vote (though single) could persuade those men that are resolved to sell such Timber, that they would also sell their Land with it; and I do not question but the Purchaser (if a Lover of Timber, as most Purchasers are) would then give more for the Timber to stand, by at least 12 *d.* in the pound, rather than have another man to buy it off from his Ground. I once observed an Ash tree in the Wood-walks at *Cashbury*, which stood in the Walk that I made through the Wood walks to *Hemsted* High way; which Ash I measured as followeth, according to the customary way of measuring by the Line of Numbers; it was a fine straight tree, tapering a little, so that I needed but to girth it in one place, it girthed just 72 inches, and was
28 foot

58 foot long, from the place where the Root was sawn off, to the place where the head was cut off: The fourth part of 72 Inches, is 18 Inches.

The Rule is as 12,
To 18 the Square in Inches,
So is 58, foot the Length
To a fourth Number;

And that fourth Number tells you the content in feet, &c.

Extend the Compasses, one point fixed in 12, (the side in Inches of a superficial foot square) to 18 Inches the square of the Tree; keep the Compasses fixed, and set one point on 58 the Length of the Tree in feet, (but it must be the 58 on the left hand, or else the Compasses will go off the Rull) and then turn the Compasses twice to the Right hand, and the last movable point of the Compasses will fall upon 130 foot, and something above a half; but that Division is so small, a man cannot read well how much it is, if it be above half a foot: This is the customary way with most men to measure trees, though it makes less than there is, which in reason ought to be considered in the price, and not in the false measure: but I will here shew you how to work both the customary and the true way, by the Rules of Natural Arithmetick; that so you may trie whether you have measured right by the Rule and Compass, or no; and also that you may see the sweet Agreement between Geometry and Arithmetick.

And first to work it by the customary way; here we take the fourth part of the Circumference to be the side of the square of the Tree, (though erroneous) and measure it as a Cylinder. The fourth part of 72 In. is 18 In. which multiplyed in its self, gives 324, the superficial Inches of one end:

Then 58 (the Length) multiplyed by 12, gives 696 Inches, the Length of the Tree in Inches;

And 696 Inches multiplyed by 324 Inches, gives 225504, the square Inches, which summe divided by 1728 (the square Inches in a solid foot) gives 130 foot and a half.

1. 8 (864

2. 2. 1.

1. 5. 3. 7. 6

2. 2. 5. 5. 0. 4 (130 ⁸⁶⁴ 1728:

1. 7. 2. 8. 8. 8

1. 7. 2. 2

1 7

I thought by the point of the Compasses it had been a little above $\frac{1}{2}$ a foot, but it is just half a foot:

R

18	58
18	12
<hr/>	
844	116
18	58
<hr/>	
324	696
<hr/>	
	696
	324
<hr/>	
	2784
	1392
	2088
<hr/>	
	225504
	Thus

Thus having shewed you, both by Lines and Numbers, what there was of this Tree the customary way, I shall here shew how many foot of Timber there is in it, the true way, still supposing it to be a Cylinder, that is, a round Figure of equal Circumference in all parts: there be severall wayes to measure it, as by having the Circumference, or by having the Diameter at the End, or by having the side of a square equal to the Base thereof; but we having the Circumference, which is 72 Inches, I shall proceed that way:

And first by the Rule and Compasses, the Circumference being 72 Inches: and the Length 696 Inches; how many solid feet are there in such a tree?

As is the standing Number 147: 36,

To the Circumference 72 Inches,

So is the Length in Inches 696

To a fourth Number:

And from that to the Content in feet, 166, and near half; that Division being so small it cannot well be read on a two-foot Rule.

Extend the Compasses from the $147\frac{6}{100}$ point, to 72 on the left hand; keep the Compasses fixed, and set one point on the Number 696 (the Length in Inches;) and then turning your Compasses twice from that Number towards the left hand, the point will fall upon 166. and near a half, the solid Content in feet:

Or more easily thus: As is the standing Number 42: 54.

To 72 Inches the Circumference,

So is 58 foot (the Length,)

To a fourth, and that fourth to 166 foot and a $\frac{1}{2}$ fore.

Extend the Compasses from 42: 54, to 72 the Circumference in Inches, that Extent will reach from 58 foot (the Length) to another Number, and from that Number to 166 foot and somewhat more, but how much more I shall shew you with my Pen, and the ordinary way of working; though Log. is much easier, but some may not have tables, or not understand them if they have.

Now having the Circumference given, which is 72 Inches, we must find the Diameter, and the Rule is,

As 22 is to 7, so is 72 to $22\frac{91}{100}$ Inches, the Diameter near 23, as here it is wrought:

$$\begin{array}{r} 7 \\ \hline 304 \end{array}$$

$$\begin{array}{r} 2 \text{ (20)} \\ 180 \\ 884 \text{ (2 } \frac{20}{21}) \\ 222 \\ 2 \end{array}$$

Or

Or you may do it by two turns of your Compasses;

Extend your Compasses from 22 to 7: the same Extent will reach from 72. to neer 23; for it wants but 2. of 22:

Or, if you will have it in more exact terms, then,

As 3. 140,

To 1.000;

So is 72 Inches, the Circumference,

To 22 $\frac{20}{7}$ that is neer 23 the Diameter.

Now for the Content of the Head, multiply half the Circumference by half the Diameter, and it giveth the superficial Content,

Half Diam. 11' 5

Half Circum. 36

690

345⁰

414'0 the Content in Inches :

This multiplied by 696 (the Length of the Tree in Inches) giveth the solid Content in Inches, and that sum divided by 1728 (the Inches in a Cubical Foot,) sheweth you how many foot and parts are in the tree.

The Length in Inches is 696

The Content of the Base is 414

2784

696

2784

The whole Content 288144
in Inches

1

5.2

1.3.

2.4. (1296

1.3.6.9

5.5.1.4.

1.1.6.3.6.6

2.8.8.1.4.4. (166

1.7.2.8.8.8

1.7.2.2.

17.

The whole Content in Cube-feet is about 166, and a little more; for if you come within $\frac{1}{2}$ of a foot in such summes as this, with the Rule and Compasses, 'tis well.

When this Tree was fawn off a little above the Root, I told just 72 annual Circles; some of them were the greatest that I ever yet saw in any tree, and those were about the middle of its Age; some three made above one Inch, so that the tree then did grow above two Inches in Diameter in three years time; but at first and of late, for some 6 or 7 years it did increase but little; for it was neer at its full growth,

so that if you multiply 12 the Semi-Diameter (for it was 24 Inches at the Root-end) by 6, it gives you 72, so that it did grow one year with another 2 Inches in 6 year, or one Inch in Diameter in three years.

I do not bring this Tree in for its Greatness, but for its quick growth, and fine Length of Timber, which was helped by its situation, it standing in a Valley, and set round with many other great trees. If this tree had been sold alone, it being such a straight Tree, and such a tough grane (for your great grand Trees are alwayes the toughest) to some Pike maker, &c. it had been worth 1 s. 6 d. the foot, at which price the very timber comes to 09 l. 15 s. 09 d. then the Head and Roots would well pay for the Stocking and making up the wood, and make up this summe Ten pound too.

I do not bring this to compare with Trees that are and have been; for the ingenious Author in his *Discourse of Forrest-trees*, pag. 84. tells you of a Tree worth 50 l. as affirmed by Capt. Bullock; but I mention it to shew those that love Trees, what Profit a thriving tree brings them yearly: And I dare affirm, that they had better pay Use for Money, than cut down a tree that stands in a good place, and is in a good thriving Condition: therefore if your trees be growing and increase in shoot, be not too hasty in felling, and when they are decaying it is too late, therefore let them not decay too long before you fell them.

When your Wood is come to the growth you intend to fell at, if your Wood be thick of wood, then fell the Timber-trees and underwood as close to the ground as you can; but if your wood be thin, then stock up your trees, especially if great timber; and the Winter after, into these holes where you stocked up the trees, set Elm, Cherry, Popler, Sarvice, and Sallow-Cuttings; so will these trees, which are subject to grow from the running Roots, thicken your woods: the Roots will pay for the stocking; you will have a foot or two of the best of timber, and the Roots of other wood will grow the better in the loose ground where you made the holes: whereas the old Roots would keep the Ground from nourishing, or any from growing there for many years. If your Ground be a shallow Soyl, do not fill up the holes quite, but set in some Running wood, the Ground being deep by the hills, will make the other wood grow better, and the ends of several Roots being cut, will shoot forth at the sides of the hole, and the holes will receive Seeds which the wind will blow into them, and there being weeds to choak them they will grow well.

For these Reasons I stocked up all the great trees which we felled in

in our Wood at *Cashbury*, and I set in an Elm and a Cherry by the sides of the holes, and the Spring after there came out of the side-roots of Maple, Cherry, &c. which made good shoots, and many Sallows came up in the holes, whereby our Woods were very well thicken'd, to the Content of my ingenious Lord, though many people were much against it, because it was not used so to be done.

If your Wood be thin, at every felling lay some boughs, which are most convenient, into the thin places; and before next fall you will have them well rooted, and good shoots from them; A man will doe a great many in one day, for which you will be well satisfied in time.

December and *January* is the best time to fell Timber, but the Oak in *April*; if you would have the Bark, when the Moon is decreasing, and the wind not East.

When the Stubs of your under-woods are grown great, stock them up: This is found to be good Husbandry with us in *Hartfordshire*, which they call Runting their Woods; it makes way for Seedlings, and young Roots to run the better: Do this at felling time, whereforever you have felled Trees at the Ground. When the Roots begin to rot they then come up best, then stock them all up, the other Wood will grow the better, and they will pay you well for your Charge; they will cost you about 6 s. a Stack, and here they will be worth 12 s. or more, when stocked up.

When you fell your Woods or Coppices, cut them smooth and close to the Stub, and a little slanting upwards, as I advised you about Lopping Pollards: the oftner you fell your Woods, Coppices, or Hedges, the thicker they will grow; for every felling gives way to the young Seedlings to get up, and makes the weak Plants shoot strong. Those Woods which increase by running Roots, as Elm, Cherry, Popler, Maple, Service, &c. which thicken your wood much: And Felling makes the Roots of a tree to swell, as Lopping doth the Body; and so it produceth the greater shoots, and comes sooner to perfection: Whereas great wood, and old, and ill-taken off from the Stub, many times kills all.

When you fell your Woods, leave young Trees enough; you may take down the worst that stand, next fall; especially neer a great tree that you judge may go down next fall, for by its fall it may spoyle some: The Statute saith, you are to leave twelve score Oaks at every Fall, on an Acre; for want of them, so many Elms, Ashes, Beeches, &c. But leave according to the thinness of your wood, and where under-wood sells well, there let your Timber-trees stand the thinner; and in such

such Countreys where Coals are cheap, and Timber sells well, there let your Timber-trees stand thick, and then they will need but little pruning up.

Endeavour to plant in your Woods such sorts of Wood as the Ground is most proper for; if wet, then Alder, Sallow, Willow, Withy, &c. if shallow and dry, Ash, Cherry, Beech, Poplar, &c. if shallow and wet, Hornbeam, Sallow, Sarvice, &c. but remember that the Oak and Elm be entertained in all places. If your Woods or Coppices be in Parks where you lye open to Deer, then at every Fall plant in them such woods whose Barks the Deer do not much love, such are the Hornbeam, Hasel, Sycamore, &c. When Trees are at their full growth, there be several Signs of their Decay, which give you warning to fell it before it be quite decayed: As in an Oak, when the top-boughs begin to die, then it begins to decay: In an Elm or Ash, if their head dies, or if you see they take wet at any great Knot, which you may know by the side of the Tree being discolour'd below that place before it grows hollow; or if hollow, you may know by knocking it with the head of an Axe, of which you may be the surer satisfied by boring into the middle of it with a small Auger; or if you see the Nighills make holes in it: these be certain Signs the Tree begins to decay, but before it decays much, down with it, and hinder not your self.

CHAP. XXXVII.

How to take the heighth of a Tree several wayer, the better to judge the worth of them, &c.

HAVING shewed you how you may judge of Timber, whether it be sound or not, in the last Chapter, I will now shew you how to take the heighth, that you may the better know the worth of it; for where you have a Rule to go by, you may then the better ghes.

There be several wayer to take the Altitude of a Tree or Building that is perpendicular: as by a two-foot Rule, or two Sticks joyned in a right Angle, (that is square as the Figure A. B. C. having at A. a pin or hole to hang a Thred and Plummets on.

Suppose you were to take the height of X Y, first then hold that
end

end of your Square marked with C. to your Eye, then goe backward or forward, till the Thred and Plummēt hang juſt upon the middle of your Square, perpendicular, and your eye looking through two ſights, or two Pins at A. and C. or over the ends of the Square, thus look to the very top of the Building at X.

(See Fig. 8, 9.)

Which found, with a Line and Plummēt from your Eye at C, let fall to the Ground at D, meaſure the length of that Line, and adde it to the height, that Length to E; then meaſure the diſtance from E. to the foot of the Altitude, as at Y, and that (if your Ground be level) is the height of of X. Y.

Or take the Level from your Eye to the height, and adde that which is below the Level to the Height, &c. as the Line C. F. ſheweth.

To find the height of a Tree, &c. by a ſtraight Staſſe, or by a Line and Plummēt, the Sun ſhining, the Altitude perpendicular, and the Ground Level; if not, you muſt make the end of both the ſhadows level to each foot, which is ſoon done.

As if I ſhould take the Level of B. at C: finding the very top of the ſhadow to End there, I meaſure the Diſtance from C. to B. and find it 60 foot; then at that very inſtant I ſet up a ſtick perpendicular, as E. D. 12 foot long, which I find to caſt a ſhadow juſt 9 foot; and then the Rule orders it ſelf thus: As 9 foot to 12, ſo 60 foot to 80, which you will find true, if you work it by Logarithmes, or by Rule and Compaſs thus; Set one point on 9, extend the other to 12, that Extent will reach from 60 to 80: Or if you work it by Natural Arithmetick: as 9 is to 12, ſo 60 to 80.

60	
12	

120	720 (80
60	9

720	

(See Fig. 10.)

The ſame may be done by Line and Plummēt.

To take the Altitude or height by a Bole of Water, or by a Looking-glass placed parallel to the Horizon.

Place on the Ground a Bole of Water, or a Looking-glass, at a convenient distance from the Building or Tree, as far as you think the height is, then go back till you espie in the middle of the Water or Glass, the very top of the Altitude; which done, keep your standing, and let a Plum-line fall from your Eye till it touch the Ground, which gives the height of your Eye from the Ground. 2. Measure the distance from your Plummet to the Middle of the water. 3. The distance from the middle of the water to the foot of the Altitude.

Which Distances, if you have measured exactly straight and level, by Proportion you may find the Altitude required, thus:

As the distance from the Plummet level to the Center of the Water or Glass

Is to the height of your Eye from the Ground, which is the Length of your Plum-line,

So is the distance from the Center of the Water to the Base or foot of the Altitude exact perpendicular, to the very top of the height which gave the shadow to the Altitude; for if your Object be not upright, and you measure straight and level, and just under the top that gave the shadow: If you miss in any one of these, you are quite out in taking the height.

Example.

Suppose the Altitude A. B. the Glass or Bole of Water imagine to stand at the prick in the square C. you standing at D. your Eye at E. seeth the top A. in the middle of the square, your distance from D. to the middle of the square, is 7 foot and a half:

Your distance from your Eye to the Ground E. D. 5 foot.

The Distance from the middle of the square to the prick at the foot or base B. is 120 foot.

(See Fig. 11.)

$\begin{array}{r} 4 \\ 650(80:120 \\ * 7:5 \\ 850:0(80 \\ 7:50 \end{array}$	$\begin{array}{r} 5 \\ \hline 600 \end{array}$	<p>As 7' 5 : is to 5, so is 120 to 80 foot ; or adde a Cypher to the 600, and a Cy- pher to the 7 foot and $\frac{1}{2}$, and divide as before.</p>
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Thus may you take the height exactly.

To take an Altitude accessible, at one station, by the Quadrant.

Suppose A. B. the Altitude as before, take your Quadrant, and looking through the sights thereof go nearer or further from the Altitude, till you see the top at A. through your sights; and also that your thred at the same time fall just at the same distance, upon 45 degrees of the Limb of the Quadrant, then measure the distance, upon a level Line from your Eye, to the Altitude from the place where you stood, and if the Altitude be perpendicular that distance is the height.

But if it happen so that you cannot take sight at that distance, then goe nearer the Altitude, till the thred fall upon 63 deg. 26 min. in the Limb; this distance being doubled, and your height from your Eye to the Ground added, makes the height of the Altitude; if the Ground where you stand be level with the foot of the Altitude; if not, you must make it level.

Or if you find it most convenient to take your sight at a greater distance than where the Line or Thred hangs or falls upon 45 degrees, then goe to the Complement of the last *Examp.* of 63 deg. 26, till the thred hang upon 26 deg. 34 min. in the Limb; the distance being measured, and the height of your Eye upon a level to the Altitude added, makes double the height of the Altitude.

These Rules be so plain, there needs no more *Examp.* but the larger your Quadrant, the better; and note that if the ground be not level, you must find the Level from your Eye to the foot of the Altitude; and also measure the distance upon a level and straight Line, alwayes minding to adde what is below the level of your Eye, to the distance measured.

When you take an Altitude, make use of two of these Rules; the one will confirm the other; for the Rules are all true in themselves; therefore be you so in working them.

Thus having shewed you how to take an Altitude by the most usefull Instrument, the Quadrant; I shall now shew you how to do it by the Doctrine of Triangles: And if you would be more satisfied in that most usefull and pleasant study, read these Learned mens Works: Mr. Bridges *Trigonometria Britannica*, Mr. Gellibrans *Trigonometrie*, Mr. Wings *Astronomia Britannica*, his *Geodæus Practicus*, Mr. Wingates *Use of the Rule of Proportion in Arithmetick and Geometry*, or Mr. Newtons *Trigonometria Britannica*, pag. 51. whose Rules I shall observe, though the *Examp.* be my own, and as before, to take the height of a Tree.

The Angles and one *Leg* given to find the other in the Rectangular Triangle A. B. C. the *Leg* B. C. is inquired.

$$\left\{ \begin{array}{l} \text{Leg A. B. 80 foot :} \\ \text{Angles } \left\{ \begin{array}{l} \text{A. C. B. 45 deg.} \\ \text{B. A. C. 45 deg.} \end{array} \right. \end{array} \right.$$

The Terms of proportion are thus :

As the Radius
To the Leg given,
So the Tangent of the Angle conterminate with the given Leg
To the Leg inquired.

Illustration by Numbers.

As the Radius : ————— 10' 0000000
To the Leg A. B. 80. ————— 1' 9030893
So is the Tangent of B. A. C. 45 d. 10' 0001515

To the Leg B. C. gives 80: $\frac{0:8}{1000}$ 1' 9032408 :

(See Fig. 12.)

You see the difference is not the 28th part of 1000. and it is worth minding how it doth exactly agree with the first Examp. of the Quadrant, &c.

It may be wrought otherwise thus :

As is the Sign of the Angle opposite to the given Leg
To the Sign of the Angle opposite to the Leg inquired,
So the Leg given
To the Leg inquired.

Or thus :

As the Tangent of the Angle opposite to the given Leg
Is to the Radius,
So is the Leg given
To the Leg inquired.

Thus have I shew'd you how to take the height of a Tree, or any other Altitude, several wayes ; now if you would judge the worth of a Tree standing, first take the height to the very top, or neer it ; then
take

take the Height of the Length of Timber, so far as your Reason tells you you might measure it if it were down; subtract the Length of the Timber from the Length of the height of the whole Tree, there then remains the Length of the head. Thus have you the Length of the Timber and Head; Next of all set a Ladder to your Tree, and girt it in such place as is most convenient, allowing for the Bark; then according to the customary way of measuring, you may know the Quantity of the Timber, and so consequently the worth of the Timber, according to the price where the Timber is standing.

The Timber of the Tree may thus, easily, and neer to the Quantity be ghesst at: The head will be more difficult, because of the different Forms they grow in; and besides, some Timber-trees head much lower than others, so that for want of helping up, either by their not standing near others to draw or help one another up, or for want of pruning up while young, they head low, and run into great Arms of good lengths of Timber; with such Trees you must goe the higher into the Arms, accompting them with the Timber as your Reason will best direct you.

Now then to estimate this head by Rule, I do judge, that if all the boughs of the head of most Trees were in an intire piece, from the place where they were cut off from the Timber, to the very top; the nearest (and I suppose exactest) Figure of any would be a Cone, or near to a Conical form that the head ends in: For we see that when a Tree is headed, it breaks out into a great many shoots, and as the Tree growes higher in the Lop, some of these shoots decay, still the more endeavouring to end in the figure of a Conical Body: and so the head of your Pollard-trees being greater than the Body, is occasioned by the Sap swelling that place, endeavouring to break out nearest to where it was accustomed to go up the boughs, it searcth for a passage, till it can contain it self no longer, and so swells the head.

This head commonly goeth with the boughs, and doth the better help them to be allowed this Form, whilest young; so that take a tree headed or never headed, it still ends in this Figure, nearer than any other, especially those that never were headed: this being then the nearest Figure part of the head can be reduced into, this being granted, it is as easily measured; for if you multiply the Basis by one third of the Altitude, the solid Content of the Figure is had, which you may value at such a price as Fire-wood beareth with you.

I will give you one Example, and it shall be of an Ash, which was felled in a place called the *Old Orchard*, by the Stables at *Cashibury*: This tree I observed by several of the Rules before, and found it to

be 80 foot high from the ground to the top-shoot; I also observed the height of the Timber to be 56 foot long; by the same Rules then, setting a Ladder to this Tree about 25 foot high, I girthed it with a pack thred (which place I took for the middle girth being the Tree did not taper) and it girthed 64 Inches upon the Bark; But most men that buy timber by the foot, have the Bark taken off at the girthing-place, or an Allowance for the Bark; but you may readily know the girth of the Tree under the Bark, though the Tree be standing or lying, without ever taking off the Bark, or making Allowance by ghes, as some doe; which to perform, find with your Penknife, or Prickers, the thickness of the Bark, or you may cut a hole thorow the Bark in the girthing places, or two or three holes, and then observe the mean thickness: As on the foresaid Tree, the Bark was half an Inch thick, doubled makes one Inch, so then the tree is less by one Inch in the Diameter when the Bark is off, then by this general Rule, as 22 is to 7, so is the Circumference to the Diameter.

Examp. by the Line of Numbers.

Extend your Compasses from 22 to 7, the same extent will reach from 64 to 20 and near a half, for the Diameter of the Circumference of 64.

Examp. by Arithmetick,

As 22 to 7, so is 64 to 20 $\frac{8}{11}$, the Diameter.

$$\begin{array}{r} 7 \\ \hline 448 \end{array} \quad \begin{array}{r} 448 \text{ (20 \& } \frac{8}{11} \text{)} \\ 222 \\ 2 \end{array}$$

But the Bark taking one Inch off from this Diameter, it is then 19 Inches and $\frac{8}{11}$, then to find the true Circumference under the Bark, agreeing to this Diameter; say thus, As 7 to 22, so is 19 $\frac{8}{11}$, to 61, the Circumference, or near it.

For if you extend the Compasses from 7 to 22, the same will reach from 19 $\frac{8}{11}$ to 61, very near.

Or you may turn this 8 into a Decimal Fraction, for as 22 is to 100, so is 8 to 36 of 100 and near a $\frac{1}{2}$.

Thus by four turns of your Compasses on the Line of Numbers you may in a moment find the Circumference under the Bark, which here we find to be 61; then according to the customary way of measuring, (though not the true way) take one fourth part of the Circumference, and say, As 12 is to this $\frac{1}{4}$ part of the Circumference in Inches, so
is

is the Length in feet twice repeated, to the content in feet or parts.

Examp.

The fourth part of 61 is 15 and $\frac{1}{4}$ Inches, extend your Compasses from the point 12. on your Line of Numbers, to 15 $\frac{1}{4}$: that extent will reach from 56 to 91 foot and neer a half, being twice turned to the Right hand, which must alwayes be if the $\frac{1}{4}$ of your Circumference be more than 12 Inches, if less, then to the Left hand.

Thus having found the Timber of this Tree to be 91 foot and a half (which must be valued according to the worth of Timber in the place where you are) here I will value it at 12 *d.* the foot, (though it was sold with courser Timber at an under-price) this at 12 *d.* the foot, comes to 4 *l.* 11 *s.* 6 *d.* Now to measure the head of this Tree according to our supposed Rule aforesaid, if you take 56 (the Length of the Timber) from 80 (the height of the Tree) there remains 24 foot for the head: This 24 foot, which is the head, two parts of it I measure as a solid Cylinder, and one part as a Cone: for if you girt all the boughs a little above where they break out from the Timber, and adde the several girths together, they will girth more than the Timber where the head was cut off; two parts of the 24 foot is 16, which I measure by the same Rule I did the Timber, by the Line of Numbers, and the same Girt.

As 12 is to 15 $\frac{1}{4}$ (the square in Inches,)

So is 16 (the Length in feet twice repeated) to 26 foot $\frac{1}{4}$ for the $\frac{1}{4}$ of the Head:

Now for the $\frac{1}{4}$ of the Head, which must be measured as a solid Cone, we must find the Basis, and multiply the Content thereof by one third of the Altitude.

The Circumference of the Basis was 61, but I will take it now for 60 Inches; then as before, As 22 is to 7, so is 60 (the Circumference) to the Diameter, which is 19 and a little more; that which is more I neglect, as not worth minding in such a business as this.

Half 60 is 30, half 19 is 9 and $\frac{1}{2}$.

Ex. to work it by the Line of Numbers:

Extend the Compasses from 1 to 9 and $\frac{1}{2}$. the same will reach from 30 to 285, the Content in Inches of the Basis, then $\frac{1}{4}$ of 8 foot is 32 Inches;

285	Then say, As 1 to 32, so is 285 to 9120	4
32	Inches, which divided by 1728 (the In. in	05.8 (480
570	one foot square) is 5 foot and $\frac{1}{2}$, and a little	4'6"2'0
855	more; this added to 26 foot $\frac{1}{4}$, make 32 foot	9'1'2'0 (5
9120	for the Head, which at a Groat per foot,	1'7'2'8

is.

is 10 s. 8 d. But this must be valued according to the Countrey you are in.

So according to these Rules, this Tree was worth 5 l. 2 s. 2 d. there was of the Head one Stack, and near a quarter, and 12 Faggots; it cost 3 s. per Stack to cut out, and was worth in the place where it stood, 10 s. You see how near the Rule agrees with this tree; but if the tree stands hanging down hill, it will then endanger the Timber in falling; or if you fear the Timber to be faulty, or some of the Arms blown off, you must judge accordingly, &c.

It is oft found in your great Elms and Ashes, that they be hollow within and yet good Timber on the out-sides, especially some length of them toward or at the lower end: Now I will shew you how you may judge very near the Quantity of Timber that is in one of these trees, or a piece of them, according to the customary way.

Examp.

A piece of a Tree 12 foot long, and hollow and decayed wood at one end 12 Inches Diameter, at the other end hollow and decayed 6 Inches Diam. The piece was 26 Inches Diameter under the Bark. First I measure the piece as if all sound Timber, then the hollow and decayed by its Diameter; that being deducted from the piece, sheweth how much sound Timber there is in foot and parts, measured the customary way.

As 7 to 22, so 26 to 81 $\frac{1}{2}$ the Circumference; the $\frac{1}{2}$ of it is 20 and $\frac{1}{2}$, and somewhat more: as 12 to 20 $\frac{1}{2}$ in Inches, so is 12 (the Length in feet twice Repeated) to 39 foot and $\frac{1}{2}$, the Content as if it were all sound.

Then for the hollow, I take the mean Diameter to be 9 In. As 7 to 22, so 9 to 28 and $\frac{1}{2}$, the Circumference of the hollow $\frac{1}{2}$ is 7 In. then as 12 to 7, so 12 foot to 4 and $\frac{1}{4}$ near; which taken from 39 foot and $\frac{1}{2}$, leaves 35 foot and $\frac{1}{4}$ for the sound Timber of that piece.

CHAP. XXXVIII.

Of making Walks, Avenues, or Lawns.

AS for making of Walks in Gardens, I shall not speak of that in this place, because I have resolved to keep my walk without the walls: there are several Books of Gardening that have many Drafts and Knots in them, but they be all done by ghes, and none of them fitted to a scale, to inform what Ground they be most proper for; so that they be as fit for Butter-Prints as for Knots in a Garden.

Most Walks that are made abroad, they either terminate, or end, or lead to the Front of a House, or Door, or Garden-gate, or other Gate, High-way, or Wood, &c. Now if you would make a Walk from any one of these, and have resolved upon the Center or Middle Line of the Walk, as the Middle of a Door in the Front of a house, or the like, there pitch up a straight stake, and then from the square of the Front, &c. raise a Perpendicular from this Stake, and at a convenient distance in this perpendicular Line, set up another stake; let these two stakes be two little stakes at first, but that at the Centre alwayes the highest; these two stakes being thus fixed, and you fully concluding them to be in the Mid-line, then come to the Centre-stake, and having in readiness a Quantity of Stakes, according to the Length of your Walk, bid one of your assistance go as far as you can well see back-sight and fore sight, and there by the motion of your hand or hat, and his own back sight, let him fix upright one stake as exactly as may be in the Line, then take up the two little stakes, and at the Centre fix in a stake six foot high, straight and upright, with paper on the top, and exactly in the place where the little stake stood: Thus having got two stakes placed (the Middle-stake and the Centre-stake,) you may if your Walk be level, and the ground clear, and the Walk not above one mile long, set up one stake at the End, in the Mid-line; looking over the head of that stake and the other, moving it till these three stakes be in a Right Line; so may you have the middle line of your walk by these three stakes exacter than by more: for the fewer stakes you use in your mid-line, the better; because that if you be but
once

once a little amiss, the more stakes are used, you will be so much the further out of the right way.

And note, it is better to take your sight over the head of your stakes, than to look by their sides; therefore you must have the Center-stake highest, the next a little shorter, and so the next shorter than that, &c. but if your Ground be not level, then order your stakes accordingly, as thus:

And if your Ground be not level, or be of such a length, that you cannot well see from End to End, then you must place down more stakes, *viz.* between the Middle-stake and Centre-stake one, and between the Middle and End-stake one, if need require more. I have oft made use of a sight-stake, which I had only to find the place where my other stakes should stand; this stake was made with a slit in the head half a foot deep, which I looked through over the heads of the rest, till I found the place where to set my stake right in the Mid-line: It is of good use, and *Fig. 13.* may somewhat represent it; you may make it to slide up and down, the better to come to the Level of the head of the stakes.

(See *Fig. 13.*)

When you take sight, to set any stake true in a Line with others, stand at a little distance with your Eye from the head of the stake, so shall you set it *Exacter* in the Line than when your Eye touches the head of the stake; set your stake so that you may onely see three stakes in a Line: let your Walk be of what length it will.

Having thus staked out your Mid-line, strain a Line in this Mid-line, and lay a square to that Line, so set off the breadth of your Walk exactly square to your Middle-line, then set up stakes (as you did) against every stake in the Middle of the Walk, and when you have got the Lines true, where your Trees must stand, then drive down Oak-stakes in the Line to the head, and then it is but putting down high stakes by these when you come to set your Trees.

Then having resolved on the distance to set your Trees at, and provided good store of small stakes, take your Chain (and not a Line, for that will stretch and shrink) and with your help set little stakes down-right in this Line, and square where you would have every Tree to stand, these stakes are to make your holes by, which I would have at least three foot wide, and two foot deep, and the holes made a Quarter of a Year before you set your Trees; if it were a year 'twere the better, keeping the Mould turn'd over now and then, and mixing it with Earth or Dung, if need be; then when the time of Planting is come, begin betimes; however, on dry ground; set up Stakes by every Oak-

Oak-stake you left in the Row before, having pruned the Roots and Heads to an equal height, set them right one Tree against another square.

And if your Trees be not all of one Size, set the greatest first, right one against another, and so lesser and lesser by degrees, minding that both Rows go on square together; and be sure you mind to let your Trees be at equal distance from End to End; then if you have a point fixed at both Ends, you must run over that distance you resolve to plant your Trees at, before you set your Stakes, and if you find it is over or short of equal distances, then must you adde or substract this odde open to or from the rest, to make them all of equal distance. See *Chap. 33.*

Now having your Trees and all things in Readiness, set them by the Stakes standing in the Rows, minding to set every Tree to range with the Stakes by back-sight and fore-sight: Cover and part the Roots with fine Mould; and when they be all covered, lay on some Rotten Dung over that Mould, and then cover that Dung with a little Mould: this Dung will keep them from friezing in Winter, and from drying too much in Summer; and also well prepares the water for the Roots. Thus having set them, take care to fence them in at such places where need is, so will you as well as I reap a great satisfaction, if you let not the Dung touch the Roots.

Do not mask a fine Front, nor vail a pleasant Prospect (as too many doe) by making the Walks too narrow. If you make any Walk that leads to any pleasant Front of a House, or other Object; if it be but half a mile long, let it be at least forty foot wide, but if longer, more, as 50 or 60 foot wide, or the breadth the length of your Front; But if you be for walks of shade, then make three Walks, the middle one 40, the two out-side walks each 20 foot, or 50 and 25 the out-side walks, or divide your Front into two parts, and let the middle be as broad as both the side-walks; so that if you make three walks together, let the middle one be as much as both the other, so will the Trees range much the better, whether you set them square or triangular; but however keep to one of them, though I think the square to be the best, because then four Trees in the four Rows end all together, fit to end in either Semicircle, segment of a Circle, Oval, Triangle, or Circle; for all walks of any Length, especially in Parks, should end in some one of these Figures, or lead into some other walk; but where they doe fall into another walk, there should be a Circle to receive them, or else they seem much defective.

I shall now endeavour to shew you how to make a walk through a
T wood,

wood, and then I will give you an Example of some of the Figures that Walks ought to end in.

Suppose you were to clear a Walk or Line through a Wood, for to run the Mid-line true about three yards wide; having the Centre given, doe as before, run your Mid-line as far as you can into the wood, and at one yard distance on each side the Mid-line, two other Lines; Run these Lines also as far as you can into the wood, keeping them just one yard distant, and setting up stakes (as you proceed into the wood) with large whites, all of a bigness, as half a sheet of white Paper on every Stake spread abroad; when any of these three Lines come to a Tree, run on the other two till you are past the Tree, and then set him off again in its place, parallel to his fellowes, and so proceed till you be through the Wood, marking that wood which must goe down; then when your under-wood is stocked up, run out your Line again; still when you come to a Tree, set off Parallels; and when past, set off into your true Line again: This way I cut a straight Line through the Wood walk at *Cashiobury*, from the North front, over one wall and several Hedges, neer a mile long, and when I came to stake it out true, there was at the very end not four foot difference, as the ingenious *Hugh May Esq*; can witness, and several others.

This way of staking out a walk by three Lines is worth your practising; in setting out of Walks that go through Hedges or Bushes, be sure to carry on the Mid-line of the walk, and the two Lines where the Trees must goe, together; now and then measuring to see if they keep their equal distances, and that which is amiss you will soon find, and may as soon rectifie it again.

There is another way of carrying a straight Line through a Wood, which Reason taught me, and by Experience I have found true: the place where the middle of the walk should poyn't to, being given, there hang up a large Candle and Lanthorn, and having found the Mid-line some 20, 30, or 40 yards from that, there hang up another, they must both hang pretty high, but let that next the House or Center be the higher; having thus placed your two Lights, and in a clear calm night (but not too light) goe with your Man to the further side of the wood, till you make both these Lights in one Line, and then walk on, keeping them so. marking the Trees on each side of you, quite through the Wood, order them to be cut down at leisure; so shall you have a straight Line cut through the Wood.

But if you are to make a walk from Gate to Gate, so that you are tied to such a Center at each End, if your walk be so that you can see from End to End, it is then but setting up two Stakes, one at each end,
by

by the sight of which cause a third to be set up in the middle: But if you cannot see to the far End, for Hill, Wood, or the like, then you must cause an high Pole, with a white on the top, to be set up at the End, by that and your Centre-stake cause your Assistants to set up as many as you think convenient in the Mid-line; but if that wood be so high that you cannot see a high Pole at the End, then run it over as near as you can by ghefs, take notice of the Length, and of your Error at End and $\frac{1}{4}$ and $\frac{1}{2}$ and $\frac{3}{4}$ each; at a Quarter of the Length of your walk set off a quarter of your Error, &c. And thus bring your Line till it ranges exactly from one point to another, from Gate to Gate; then set off the two Lines where the Trees must goe (as is before shewed) by the square, and if for three walks, then the four Rows of Trees; if there be three Walks, let the Middle walk be just as broad as both the other, which is the best Form; or else all three of equal breadth, so may you set your Trees not onely square, but they will answer one another several wayes beside, as square from A. to B. and other wayes, as B. to C. and to D. so that every Tree must keep his Row, Range, Square, and equal Distance, &c.

(See Fig. 14.)

The pricked Lines shew how the sight will take the Trees as square from A. to B. and Angle-wayes from C. to B. or C. to D. &c.

Thus have I shewed you how to stake out the Mid-line, and the two side-lines of your walk: I wish Sir *E. T.* Sir *W. B.* and Sir *R. B.* had seen these Directions before they had planted their walks; I do judge they then would have done them better: For Errors in planting make too many worthy Persons forbear.

Now as for the Figures which walks ought to end in, I have named them before; and if you observe, most Plants (especially Trees) which make your Walks, the most of them end in a Circular figure; and therefore I will shew you some wayes how Walks ought to end in a Circle: For a walk ending bluntly without any Figure or entring into another, may be compared to a Tree with the Head off, and what difference there is, let those which well observe the Objects of Nature judge. Let the Circle be three times the Breadth of your walk, if conveniently you can, or bigger if you have Room.

After you have found the Mid-line, and resolved upon the Centre, as at A. and of the Bigness of your Circle, next consider of the Distance of your Trees round the Circle; run that distance over first, and if you find an odde Tree, let it stand in the Mid-line, and in the Circumference, as at B. but if no odde Tree, then let the Mid-line pass

tween two Trees, adding or subtracting the odde Inches, till you find the equal distance your Trees must stand at, &c.

(See Fig. 15.)

Let the Trees in your Circle stand not much above half the distance that the Trees are in the Rowes, as in the last they were 16 foot sere, Trees in the walk 24 foot, but in the Oval thicker, that they may shew the Figure the better; A fine Tree in the Centre of all Circles doth well.

(See Fig. 16)

Two Walks meeting in a Point, let that be the Centre of the Circle, as at A. and there a Tree.

Two Walks crossing one another, where the Mid line meets let that be the Centre of a Circle, as B.

Note: That if your Circle be divided into two parts, by Walks, as the Circle A. find a distance that the Trees in each part may stand as neer that distance as may be, there they be near 11 foot both, and the Circle B. neer 10 foot asunder.

Now the smaller parts the Circle is put into, the thicker set your Trees round it; as B. is put into four parts by the two Walks crossing it; set these parts the thicker that they may shew the Figure the better.

Of three Walks going up to a Circle, as they doe to the Bowling-Green at *Cashibury* (which Green is 80 yards, or 240 foot diameter, with a border 16 foot wide, planted with three Rowes of Spruce-firs, set in the year 1672. being set Circular and Triangular,) see the Figure: there are 90 trees in the outer Row, and 90 Trees in the innermost Row, and 89 in the middle Row, which is 269 trees; I lost not one of these, except one that was stollen.

(See Fig. 17.)

To plant such a Border, first with a Line on the Centre B. mark out the Circle where the inner Row should goe, then set two Trees in the Circle, and in the Rows of the VValk, as at A. A. then having resolved of the distance to set them at, run that Distance over from A. A. and the odde Inches or parts adde or subtract, according to the Number of the Opens, to or from the Measure you first resolved on, as is shewed before, &c.

1. Next I shall shew you some wayes how VValks may come into or end in a Semi-circle, or Segment of a Circle, &c. as A. being a Gate, B. C.

B. C. is a Hedge or Pale, A. is the Centre of the middle of the VWalk and Circle.

(See Fig. 18.)

Or thus: The Centre at A. and then three Trees or more to go to the Pale parallel to the Walk, as 1, 2, 3.

2. *How three Walks may come into a Semi-Circle:*

(See Fig. 19.)

This may be continued on with three or more Trees parallel to the Mid-line, as in Fig. 19, &c.

3. *How three Walks may break into a Semi-circle at three several places, and how to make the Semi-circle so great, as that you may have just so much Wood on all sides of the Walks, as the Walks are broad, or to order it to what proportion you please.*

Suppose the three Walks to be each forty foot wide, which makes 120 foot, then there is to be 40 foot without one side-walk, and 40 foot without the other side-walk, and 40 foot between each of the side-walks, and the Middle-walk, which is four times 40 foot, that is, 160 foot; so that the 120 foot makes 280 foot for the Arch of this Semicircle, then find the Semi-diameter to the Arch of this Circle, and strike the Arch from the Centre.

Ex. The Semi-circumference being 280, the Circumference is then 560.

Then as 22 is to 7, or if you will be more Exact (as the Learned Oughtred in his *Circles of Proportion*, pag. 43. saith) as 3' 14.16 is to 1. so is the Circumference to the Diameter; but the other is a standing Rule, nigh enough for our purpose.

560	1.	As 22 to 7, so 560 to 178 $\frac{4}{5}$ (the
7	3.2. (4	Diameter;) if you turn this Fraction in-
—	1.7.8.4	to Inches, it will be two Inches and near
3920	3.9.2.0. (178:	half of a Barley-Corn, so then the whole
	2.2.2.2.	Diameter will be 178 foot 2 Inches, the
	2. 2.	half is 89 foot one Inch: With this 89
		foot one Inch (being the Semi-diameter)
		draw the Arch of your Semi-circle, which

Arch shall be 280 foot; and from the Centre by which you drew this Arch, may be the Mid-line of your three Walks; as is described in the Figure.

(See

(See Fig. 20.)

Let the Centre A. be in a straight Line with the pricked Line B. B. and parallel to the Middle-walk C. the Line B. A. B. may be (if Convenience serve) 50 or 60 foot from the wall, pale, hedge, and that to goe parallel to that Line; and where the wall or pale ends, there may be a Row of Trees continued so far as you please or can, &c. At the Centre A. let be some fine Tree set, or some Figure, &c. I once saw a Semi-circle set out somewhat like this, where I saw a great deal of measuring before they could proportion it exactly to such a place as was intended: I took my Pen, and by these Rules I told them justly how far they should goe. More I could say, if I thought it not unreasonable now.

Here you see how to proportion a Semi-circle, which you may enlarge with three, four, or five Trees on each side, and parallel to the Middle-walk, as is in the second Figure of Semi-circles; but be mindfull to make such a Figure for your Walks to end in, and of such a bigness as is most convenient to your Ground; the Arch of the Semi-circle may be one Row of Trees, (as in the Figure) or two, three, four, or more, as you please; but three Rows set triangular do very well.

4. *How and where a Semi-circle is proper on the side of a Walk, &c.*

Suppose you have a Walk a Mile in length or more, it is no wayes improper, but pleasant and satisfactory to have your Walks shew you every $\frac{1}{4}$ of a Mile, $\frac{1}{2}$ of a Mile, and $\frac{3}{4}$, &c. to the End; or from each End, or from one End back to the other; as if you begin at the Centre-tree in the Semi-circle at A. then at $\frac{1}{4}$ of a Mile at the Figure 1. make a Semi-circle to break out on the Right hand, the Centre-tree to be exactly in the Row of the Walk, and just a quarter of a mile, as is shewed in the Figure as well as the Largeness of our Paper would bear by the Semi-circle Figure 1; then at the half-mile let two Trees stand in a Semi-circle, at Figure 2, one to stand in the Row that makes the walk, which two Trees is half a mile, and at three quarters three Trees; still minding that one be in the Row or Walk the Centre-tree of your Circle, and the exact distance: So one Tree the Centre of the Semi-circle, as at Figure 1. is a $\frac{1}{4}$ of a mile; two Trees as at Figure 2 is $\frac{1}{2}$ a mile, three Trees as at Figure 3 is $\frac{3}{4}$ of a mile:

(See Fig. 21.)

Though

Though the Figure doth not show well, because the smallness of the Paper will not allow Room to draw the distance of miles, as the Trees are according to Scale, (though my scale is here for the distance of the Trees 160 foot for one Inch) yet I presume, where this is really acted in Walks, it will do well: I here begin at the Centre-tree in the Semi-circle, and in the Right-hand Row, shewing how the $\frac{1}{2}$ of the mile may be set out, and shewed by the Semi-circles on the sides; at the other End, I begin at the Centre of the Circle, and so shew the $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$, how they may be set out on the other side.

Or if you please, you may have a Tree in the Mid-line of your Walk, at every quarter of a mile, with a Circle to break round that Tree three times the breadth of the Walk, which Tree must be pruned up high, or else it will hinder the Prospect of your Walk, (I fantasie the other way is best) as let a Tree stand at every $\frac{1}{4}$ of a mile, as you see in the Figure.

(See Fig. 22.)

Thus having shewed you how Walks may end in Circles, or Semi-circles, I shall now shew how Walks may end or come into an Oval, and how it sometimes happens that an Oval is the best Figure that Walks can End in.

If three Walks meet acutely at one place, then it will be necessary to have the Mid-line of the three Walks meet at a Tree in the side of an Oval; for if you make that poynt the Centre of a Circle, it will be too large, 'tis possible larger than your Ground will permit; as at *Cashibury*, where the three Walks meet by *Hemsted* High-way; for if I had made the Circle from the aforesaid Centre, and made the Semi-diameter so large as to have in the Circumference the two Trees marked A. A. which rangeth for both Walks, then would this Circle have been too great, and beside could not be made within the Pale: Now I having Orders from my Lord, that the Mid-line of these three Walks should meet at a Tree, as in Fig. 23. they doe at B. and that I should make the Figure so large as that the Wood which is between the Middle walk, and the two out-side Walks, should end at a Tree which should stand exactly in the Range of Trees, for the Middle-walk, and also for the in-side Rows of the two out-walks; by considering I found the Oval to suit best with this ground; so I having these two Trees, as at A. A. and the Poynt as at B. which I took for the Breadth of the Oval, accordingly I made it. See the Figure.

Length of the Oval is 205 foot, Breadth 124 foot, Middle-walk 50 foot, the side-walks each 40 foot wide, having wood between the Walks, and round the Oval.

(See

Now having the two Trees as at A A. and the Centre-tree of the three Walks B. from the Mid-line of the middle-walk, and in the middle of that Line between A A. and B. draw a perpendicular Line, which sheweth the Length of the Oval; at each End set a Tree, as C. C. then divide the distance between the Centre-tree at B. and the End-trees at C. C. which let be at such a distance as may best suit with the six Trees between D. and C. on each side; here the Trees between B. and C. are ten foot ten Inches distance, and the Trees between D. and C. are 10 foot 9 Inches distance; Let alwayes the Trees that make either Oval or Circle stand pretty nigh, they shew this or any other Figure the better: For this no certain distance can be given, but they must be set at such a distance as the Arch-line can be divided into, &c.

I shall shew you how to know the Length of an Arch-line, and how to make an Oval or other Figure hereafter.

This Oval and Walks are surrounded with Wood, and also between the Walks ending at a Tree, as at A A. you may make broader at your pleasure, or you may alter the Oval in shape or bigness, as your Ground and Fancy shall direct you. Your Oval may be surrounded with a double or treble Row of Trees if you fantasie it, and indeed if it be in a place where it is not encompassed with wood, it is very proper: An Oval or a Circle, are very good Figures for Ponds, though they be not in use:

Now for making Walks to end in a Triangle, this may be several wayes, according to your Fancy or Ground: But I confesse I never yet saw or heard of any Walk in *England* or elsewhere that ended in such a Figure; But why may not the best of Figures be neglected by the Ingenious Surveyor both at home and abroad, as well as we see many Excellent things known to several ingenious men, which are practised by few.

Having made at the End of Walks, Semi-circles, Circles and Ovals of several sorts, and notwithstanding that I had at the end of the three VWalks that goe from the Garden to the Bowling-green, that end next the Garden, a Figure given me by a worthy person (but how proper for that place I shall not now speak) I nevertheless neglected that, and made the Triangle as is shewed by *Figure 24.* The trees I set the closer, because this being a Front of the house intended to be hid at a distance all but the breadth of the VWalks, therefore I chose this Figure as much proper for such a design.

(See Fig. 24.)

This Line according to Scale is the Length of the Garden-walk, the
Break

Break in the middle against the great Walk, is a Grate which is intended to front it.

This Figure might be much improved if it were made a little larger, so that the inner Row of the Triangles might range a little without the End of the Garden wall, and at that end a walk to take it, to goe by the Garden-side; so might you have a convenient by-way without the VValls, from the 20 foot VValk, along either VValk of the Triangles, to the walk by the Garden-side, &c.

There are several other sorts of Triangles proper for VValks to end in, but for Shade I preferre this or the next following; if you would have the Trees to shew the shape of their heads, then a single Row is best, as the out-Row of the Triangle-walk.

(See Fig. 25.)

For a Court you would have shaded with Trees, this Figure will do well.

In this last Figure you may let the little VValk end Parallel with the VVall, and have no VValks by the side-walls; or you may make onely one VValk on each side.

As for making of the Triangle at the End of your Walk, it may be Analogically according to your Ground; though these two be made obtuse, the perpendicular half the Length of the Base: there be several sorts of Triangles or triangular Figures; but these we have here made are called *Amblygone*; that is, a Triangle which hath one obtuse and two acute Angles, &c.

Thus having shewed you most of the Regular Figures through which a Walk may pass, or in which a Walk may end, I shall now shew how a VValk may pass through a Square, and so proceed.

(See Fig. 26.)

You may make your VValks according to this Figure, or you may have the VValks break into the Square in the Middle, on every side, which Figure will do well with a Tree in the Centre, where the prick is, Thus:

(See Fig. 27.)

How a VValk may end in a Square, may well be perceived by this last Figure; besides, it is common in many places to be seen, yet in my Opinion is not so convenient for a VValk to end in as the aforesaid Figures; from these foregoing you may make several others, according to your Ground: for it is a good Rule to *Cut your Coat according to your Cloath*; and to proportion the Figure your VValk ends in, according to the best convenience of your Ground.

*Let not your hand alwayes for Copies stay,
But let an active Fancy lead your way.
Proportion still your Figure to your Ground,
Whether it be Triangle, Square, or Round.*

Some of these Figures are also the best to make your Lawns, that is, a spacious Plane joyning to your House; which let be in Largeness according as your Ground will permit, as 100 Acres or more.

This Lawn is most convenient to be on the South side, or East side of your House: For if it be on the VWest side, it giveth the more way for the west wind (which is most commonly the greatest) to harm your House, by its free passage thereto: Also if your best Rooms front your Lawn, as they alwayes should doe, the Afternoon being the most usual time in which great Persons do solace themselves in these principal Rooms, the Afternoon Sun will then be Offensive to such Rooms, and the Prospect will both be hindred and not so pleasant; for the Sun by shining against you and from the Object, doth by both hinder your Prospect; and most Prospects are most pleasant when the Sun shineth on them. These Inconveniences, which arise from your Lawns being on the west side of your House, being considered, I thence conclude, by the Rule of Contraries, that it is most convenient for your Lawn to be on the East side of your House; for there you have your Rooms shady in the Afternoon, the Objects which you view from your house much beautified by the Sun shining upon them in the Afternoon, &c.

For the aforesaid Reasons your Lawn may do very well on the South side of your House; for the Sun shining most part of the day on that side of your House, doth much adde to the beauty of that Front, which ought to be the best Front of your House; therefore a large Lawn on that side, doth much help the Prospect to the House, and also from it.

A Lawn on the North side is no wayes convenient, for that layes your House too open to the cold North winds, &c. VWherefore, let your North and VWest sides be planted with VVoods, Orchards, &c.

A Square is no ill Figure for a Lawn, thus: VWhere there may be three Avenues break out at the three Angles, or one at the Angle opposite to the House: And if your Lawn be Rising Ground to the House, some Trees set thin on the Lawn will be very pleasant. (See Fig. 28.)

Your Lawn may be bounded with VValks, if you please, which in this Figure will do well, or you may have a single Row of Line-trees to bound your Lawn with, set at a good distance one from another, they will shew the shape of their heads the better.

As the Pricks are on the Lawn, so may your Trees stand, but leave the Front clear, except the Lawn be much falling Ground from the House :

Let the Figure of the House be in the form of these two, (*Fig. 28, 29.*) or any other, yet let the Lawn be on both sides the Front alike, making an Angle at the middle of the Front, or at some Court gate right before it, and breaking off (as you see in the *Fig.*) at a convenient distance from the House : A single Row of Line-trees set at 4 Rod distance, as they be in the *Fig.* will be pleasant to bound your Lawn.

(See *Fig. 29.*)

From these two you may make several, but still mind to make such as will best fit your Ground.

A Circle is a good Figure for a Lawn, onely it must break off before it comes against the Front.

A Triangle is also a very proper Figure for a Lawn, but let it not be too Acute at the Angle which leads to the Front, but rather Obtuse, or right angled at the Angle next the Front, as in the two last Figures. I have often observed some Fields lying in the form of a Triangle, leading up between two Woods or large Hedges, and sometimes I have seen a House at the Angle ; this hath been very pleasant to my fancy, especially when it hath ascended up hill, and hath had the South, South-east, or East Aspect : Now if Noble-men and Gentlemen that have Ground convenient, would but make some such Lawns before their Houses, it would be very pleasant, and a great Ornament to their Seats. They may make these Lawns, and clear the wood that is within the Figure of them, as it decayes, or as they have occasion ; the Charge would not be great, but the Pleasure and Profit would certainly be great and lasting :

I do preferre your Lime-trees to bound in your Lawn, because it is a Tree that will grow well on any Soyl, having but care to plant it as it should be, beside the fine shape all the Trees will naturally grow in, for they will seem as though they were cut, provided they be not set too thick, for then one hinders the shape of another.

The Elm is a good Tree for this purpose, for it hath a fine green Leaf, and if the Ground be Natural for it, it will grow to a great Tree, and straight, if kept with Pruning as it ought to be : These Trees you may plant thick round your Lawn.

The Beech, in Ground where it likes, makes a stately Tree, so doth the Walnut, Chesnut ; black Cherries where they like the Ground, are quick Growers, and very pleasant in the Spring when they be clothed in their white Garments ; and indeed any Tree that is not very dangerous to remove, as is the stately Oak and Pines, which were the very best,

were it not for this fault. The Firs and Ewes are not so difficult ; they will do well where they like the Ground, &c.

Now where men have not the Convenience or the Quantity of Ground, if they make but 20 Acres in a Field in some good Figure leading to the House, it will be the more pleasant, and the Charge as little as to do it other ways.

CHAP. XXXIX.

Of several Superficial Figures, and how they are to be measured.

TO speak of all sorts of Figures will be far beyond my intentions, there being so very many irregular Figures which have many unequal sides and angles ; but they may all be brought into parts of some of the Figures following, and Measured like them ; I shall shew you one Useful Prob. especially to make your Ovals by, whether they be made from two Centres, or four ; and then I shall touch at some Superficial Figures. (See Fig. 30.)

Suppose three pricks or points given (so they be not in a strait line) to find a Centre to bring them into a Circle. This may be done several ways, viz. either by Circles, or by raising Perpendiculars ; as if the points at A. B. C. were to be brought into a Circle : Draw a line from A. to B. and in the middle of that line raise a Perpendicular, as the line D. E. which you may soon do ; for if you open your Compasses to any convenient distance, and set one point in B. draw the Arch 1. and 2. then setting one point in A. draw 3. and 4. where these cross draw the line E. D. Do the same with the points B. C. and where the two Perpendicular lines meet is the Centre, as at F, &c. Superficial Figures that are irregular and right-lined, are such whose Sides or Angles are unequal, of which some are triangles, or triangular Figures ; and here Note, that there are five sorts of triangles, which are thus Named and known :

1. *Isosceles* hath two of the sides unequal.
2. *Scalena* hath the three sides unequal.
3. *Orthogone* hath one Right and two Acute Angles.
4. *Amblygone* hath one Obtuse and two Acute Angles.
5. *Oxygone* hath three Acute Angles, or Equilateral triangles.

(See Fig. 31.)

Every triangle is half of a square, whose Length and Breadth is equal to the Perpendicular, and Side cut by the Perpendicular ; as is plain in the first Figure shewed by the pricked lines : therefore to Measure
any

any triangle, raise a Perpendicular from the Base, to the greatest Angle:

Then Multiply the whole Base by half the Perpendicular, or the whole Perpendicular by half the Base, and the Product is the Content. Or thus, take the whole Base and whole Perpendicular, and Multiply one by the other, the half of that Summe is the Content of the triangle, &c.

Square or Quadrangular Figures are these following.

1. A Geometrical-square; this hath Right Angle, and sides equal.
2. An Oblong-square, which hath equal opposite sides and Rectang.
3. A Rhombus, hath equal Sides, and unequal Angles.
4. A Rhomboides, having unequal Sides, and Angles opposite, equal.
5. Trapezia; Are all other four-sided Figures.

(See Fig. 32.)

The first is Measured by Multiplying one of the Sides in its self.

In the Second the length Multiplied by the breadth, gives the Content:

The three last may be turned into two triangles each, and so Measured as is before said.

Polygons are these Figures following: as the end of a Tree hewed into five equal sides, this is called a Pentagone; of six sides, Hexagone; seven sides, Heptagone, eight sides, Octagone; nine sides, Enneagone; ten sides, Decagone; twelve sides, Dodecagone. To Measure any of these, take half the perimeter (that is, half the Compass about) and the perpendicular drawn from the Centre to the middle of any one of the sides, Multiply the one by the other, and it giveth the Content.

Circular Figures are these, which be thus Named:

1. The Circle, is near Equal to a square, made of $\frac{1}{2}$ Diameter, and $\frac{1}{2}$ Circumference.
2. The Semi-Circle, to a square made of half the Arch-line, and $\frac{1}{2}$ Semi-diameter.
3. The Quadrant, or fourth part of a Circle.
4. The Segment, Arch, or part of a Circle.

The first is Measured by Multiplying the Semi-circumference by the Semi-diameter. The second, by Multiplying the Radius or Semi-diameter by $\frac{1}{2}$ of the Circumference of the whole Circle. The third, by Multiplying the Radius by $\frac{1}{4}$ of the Circumference of the Circle that it was made of. The fourth by Multiplying the Radius by $\frac{1}{2}$ the length of that Arch-line: thus have you the Content or Area of each.

To find the Diameter of any Circle, or the Circumference, by having

and as given, the lowest Number is, as 7 is to 22. so is the Diameter to the Circumference; or as 22 is to 7. so is the Circumference to the Diameter.

To find the Length of an Arch-line Geometrically.

This Problem is Useful to be known, for to Measure the Quadrant, Segment of a Circle, or Oval; for the Oval is made of parts of the Circle.

First, Divide the Chord-line of the part of the Circle into four equal parts; then set one of these parts from one End of the Chord-line, also set one of the four parts from the Angle in the Arch-line; then from one point to the other, draw a Line; the length of this Line is half the length of the Arch-line.

(See Fig. 33.)

Examp. A. B. the Chord-line, Divided into 4 parts, one of the 4 parts set from B. to C. and one part set from A. to D. then draw the Line C. D. which Line is half the length of the Arch-line A. D. B. which was to be found out.

Thus may you Measure this part of a Circle, or the like; but if the part of a Circle be greater than a Semi-circle, then Divide the Arch-line into two Equal parts, and find the length of one of these, as is afore-said; which doubled giveth the length of the whole Arch-line: This Rule will assist you to Measure the Oval, whether it be made from two Centres or four, &c.

There is no regular Figure but may be Reduced into some of these Figures afore-said, therefore I shall shew you the Use of some Geometrical Figures, which are very Useful; not Questioning but that you Understand the first Rules in Geometry, as, to draw a parallel Line, to Raise a Perpendicular-line from another, &c. for those things are out of my intended Discourse, therefore if you be to seek in them, consult with *Euclid* and others.

How to Raise a Perpendicular at the end of a Line, by which you make a Square, very Useful also to set off a square-line from a strait-line, in any Garden, Walk, House-end, or the like.

(See Fig. 34.)

Examp. If you be desired to set off a square-line at B. from the Line A. B. take six Foot, Yards, or Rod, and Measure from B. to C. in your strait-line, then take eight of the same Measure and set from B. to D. and

and ten of the same, holding one end at C. bring the Line B. D. till it just touch the Line C. D. at D. so have you an Exact Square made by 6. 8. and 10. See *Euclid* first Book, Prob. 47. and p. 35. *Mash. Recreations*, p. 93.

(See Fig. 35.)

This you may do in other Numbers that bear the like proportion; for *Enc.* tells you, that the square made of the side subtending the Right Angle, is Equal to the squares made of both the sides containing the Right Angle; for 10 times 10 is a 100. and 6 times 6 is 36. and 8 times 8 is 64. so 36 and 64 make 100. equal to the subtended square. There be several other ways to Raise a Perpendicular at the end of a Line, but this being so easie, and the most useful, I shall not name any other.

CHAP. XL.

To Divide a Right Line given, according to any Proportion Required; and how to Divide Land or Woods, with some Uses of the four-pole Chain.

THE Line A is Required to be Divided into two such parts, which shall have proportion the one to the other, as the Line B. hath unto C.

(See Fig. 36.)

Make an Angle of any Quantity, as A. B. C. and let the side A. B. be Equal to the given Line A. then set the Line C. from A. to E. and the Line B. from E. to C. and from the point E. draw the Line E. D. parallel to C. B. cutting the Line A. B. in D. so shall B. D. bear the same proportion to D. A. as the Line B. hath to the Line C. this is the Golden Rule by Lines.

To Divide a Right Line in Power, according to any Proportion given.

(See Fig. 37.)

Draw the Line C.D. Equal to the two Lines A. & B. then Divide the said Line in the point F. in proportion as A. to B. then in the middle of the Line C. D. Describe the Semi-circle C. E. D. and on the point at F. Raife the Perpendicular F. E. cutting the Semi-circle in E. from that point draw the lines E. C. and E. D. which two Lines together shall be equal in power to the given Line, and the power of the Line E. C. shall be in such proportion to the power of the line E. D. as A. to B.

Many Men when their Woods are felled, sell their Wood by the Acre, or half-Acre, or sometimes two or three Acres; and sometimes Men Let their Land to Plow by the Acre, and sometimes Men purchase part of a Field by the Acre: I will here shew you how you may cut off parts of an Acre, or several Acres from a Field; or how far you must go in a VWood or Field to make an Acre, more or less, of several Figures; which will be Useful to be known of most Men, for several other Occasions.

Suppose a VWood, or part of it, should be in a Triangle, as the Figure following, which should contain 745 pole $745'42''$. that is 4 Acres 105 Pole, and near a $\frac{1}{2}$. Of this VWood there is Sold 2 Acres, which is to be taken off from the Angle C. and to cut the line A. B. having Measured your Triangle, and found it as above-said, and also the Base-line to be 84 pole, then by the Rule of Three work it thus:

(See Fig. 38.)

If 745'42. (the Content of the whole Triangle) have for its Base 84 Pole or Rods; what shall 320 pole have for its Base? (that is 2 Acres) See it wrought by Logarith.

745'42 Log.	2'87240.
84. Log.	1'92427.
320 Log.	2'50514.

4'429+1.

Gives 36'06: 1'55701.

Here you see that this Log. gives 36 pole and $\frac{6}{1000}$. so that you must go 36 pole and little more on the Base-line A. B. from A. to D. for your

your 2 Acres; then the Angle $A. C. D.$ is the two Acres, or 320 Pole, and the Angle $C. D. B.$ is 2 Acres 105 pole, and near $\frac{1}{2}$ a pole.

By the same Rule may you cut off what Number of poles you please, from the Angle $D.$ to fall upon the Line $C. B.$ or to fall upon the Line $D. B.$ having but the length of the Lines given you.

But if it be Required to take off a part from a Triangle according to any proportion given, by a Line drawn parallel to any of the sides assigned.

As let $A. B. C.$ be a Triangle containing 5 acres, and it is desired to cut off 2 acres, by a Line drawn parallel to $A. B.$ first, on the Line $A. C.$ draw the Semi-circle $A. E. C.$ and the Diameter $C. A.$ Divide into 5 equal parts, and from the point of 3 of these parts of that Line draw the perpendicular $D. E.$ to cut the arch-line in $E.$ then set the length of $C. E.$ from $C.$ on the Diameter-line, and it will reach to the point $F.$ then from that point at $F.$ take the nearest distance to the Line $A. B.$ and set that distance off from $B.$ to $G.$ then draw the Line $F. G.$ exactly parallel to $A. B.$ so will the Triangle $C. G. F.$ be 3 acres, and $G. B. A. F.$ 2 acres, the thing propounded.

(See Fig. 39.)

This Rule in it self is exact, but in a large Field or Wood it is difficult to be done, because the Semi-circles and other Lines are very hard to be drawn exactly.

But if your Field, or part of it, be a square, and you are to take off some parts of it, you may do it to any Number of Rods desired, easily and exactly, thus:

Let the Field be never so great, Measure you onely that side of the Square whence you are to take off your part, exactly.

(See Fig. 40.)

Examp. It is Required to cut off 2 acres, or 320 Pole from a Field, or part of one, that is in form of the Square $A. B. D. C.$ with a Line drawn parallel to the side $A. B.$ Now, finding the side of the Square to be 32 Pole; Divide 320 (the parts you are to cut off) by 32, the side of the Square, and the Quotient will be 10; then set off 10 Pole from $A.$ to $E.$ and from $B.$ to $F.$ and the Square $A. B. F. E.$ is 2 acres, as was Required.

This is very Useful for several Men, and readily to be performed; but if these sides $A. C.$ or $B. D.$ do not go Square from the end $A. B.$ then must you find the mid-line of the Square you are to take, and Divide the Summe of Poles you are

320(10

322

3

to take off by that; the first Example will assist you to find this mid-line, and somewhat help you in the working.

This being such an usefull Prob. I shall shew you how to perform it another way, as in the last *Examp.* the side of the square 32 Pole, and you know 160 Pole make one Acre; then divide 160 by 32 (the side of your Square) the Quotient is 5; which tells you, that you must measure 5 Rod, or Poles, from the side of your Square on each End, to make one Acre, 10 Pole for two Acres, 15 Pole for three Acres, &c. which you see agrees with the former Rule.

But if it be required to take off the parts of a Square, and to have those parts in a Triangle, then the first and second Figures will assist you how to perform that.

To divide an Irregular Figure into any parts required; that is, to take what number of Rods you please from such a Figure.

As, if A B C D E. be the Figure of a Field or Wood, and it is desired to take off the half of it from the Angle at A. the whole Figure is 705 Pole, then the half is 352.50, and the Triangle A D E. is but 290 Pole, which wants 62 Pole and a half of the half of the Field; therefore take 62.50 from the Triangle A C D. by the Rules delivered in the 38th. Fig. and there will be added the Triangle A D H, which being added to the Triangle A D E, will divide the Figure into two equal parts, the thing desired.

(See Fig. 41.)

Thus may you take half from any irregular Figure, or more, or less than half, and from what Angle desired, which will assist you well how to sell your Woods by the Acre, or to know how far you shall go into a Field, to take off any parts; the fourth Rule (which I found by my Practice) I commend for very good.

One Example I shall give you more, which shall be according to my fourth Rule: I try'd it in a Field near to *Cashibury-Park*; this I was ordered to doe by my Lords Steward Mr. Sydenham, to take off three Acres from a small Field as exactly as I could, at one End appointed by him.

First I measured that End, and found it to be 37 pole and $\frac{3}{4}$, but observing the Hedges, I found them to splay off a little, so that about 6 Rod and a half, or little more, would be the middle, which
 $\frac{4}{8}$ (8 I set off at each End, and found that Line to be 38 Pole long;
 160 (4 then I divided 160 (the Poles in one Acre) by 38 (the Poles
 38 of the End of the Field) the Quotient was 4 and $\frac{8}{19}$, which
 8 of

8 of 38 I must turn into parts of my Chain, that is, into Decimal parts; thus: As 38 is to 8, so is 100 to 21 and 2 of 38; which 2 is not considerable; So that if the Chain be divided into 100 Links, you must then goe 4 Pole and 21 Links at each End for to make one Acre of Ground; but if your Chain be a four-pole Chain, divided into 100 Links, then with such a Chain you must goe 4 pole 5 links and $\frac{2}{5}$ and a little more, to make one Acre at 38 Pole long: Then for three Acres I must goe in breadth 12 Pole, $\frac{2}{5}$ to make three Acres and a little more, see it proved.

Here you may see that 12 Pole $\frac{2}{5}$ multiplied by 38 Pole, gives 479 Pole and $\frac{2}{5}$, which being divided by 160 (the Poles in one Acre) gives in the Quotient 2 and 159; so then if you adde but 6 of 100, to the 94, it is just three Acres; for whereas I take, in the Decimal parts, but $\frac{2}{5}$, I should take the 21 Links, and the 22th part of one of these Links, which niceness may be dispensed with.

From what hath been said, you may measure any standing Wood, or part thereof, especially if these parts be near to a Square or Triangle, if not, you may Reduce them to one of these.

Thus having spoke something how superficial Figures are to be measured, I shall give an Example or two of the Chain, and it shall be of the Four-pole Chain, divided into 100 parts; as suppose the Figure A B C D.

(See Fig. 42.)

This Figure may be measured several wayes; as first it may be put into two Triangles, and so measured, or else you may measure both the Ends, and half them, and so measure the Length in the middle; you may measure also both the sides and half them, and then measure the breadth in the middle. But for Example: First I measure the side A B. and find it to be 15 Chains and 80 Links of the Four-pole Chain, the End B C. is 6 Chains 74 Links, the other side C D. is 12 Chains 50 Links, and the other End D A. is 6 Chains. Then adde the two sides together, of which take the half, that half is the mean Length: both sides added together, make 28 Chains 30 links; half of which is 14 Chains 15 links; then adde the Ends together, viz. 6 Chains, and 6 Chains 74 links, the total of both is 12 chains 74 links, then half of the

15 80: one side.
12 50: one side.
28 30
14 15

Ends added together, is 6 chains 37 links: Then multiply the mean Length by the mean Breadth, and cut off 5 Figures to the Right hand, and whatsoever Figures Remain to the Left hand, are Acres; and those 5 Figures cut off are parts of an Acre.

Thus may you know the Content of a Field without Division; as in the last *Examp.* 14' 15, multiplyed by 6' 37, gives 901355, then if you take off five figures, as the fractional parts, there remains 9, which is nine Acres two Pole and above $\frac{1}{2}$ of a Pole. But you may easily know the fractional part of any Decimal fraction thus: This belongs to 100000: for if the Decimal fraction have 5 Figures, the Integer is 6, the fraction 4, then the Integer 5. &c.

Then work it by the Rule of Three, or by your Line of Numbers, thus: As 100000 is to 1355, so is 160 (the square Poles in one Acre) to 2 Poles and near $\frac{1}{2}$, but that you may be the better satisfied in this most useful Rule, if 100000 be Equal to one Acre, or 160 Pole,

Then 50000. to $\frac{1}{2}$ an Acre, or 80 Pole;

25000. to $\frac{1}{4}$ of an Acre, or 40 Pole, which is a Rood.

12500. to $\frac{1}{8}$ of an Acre, or 20 Pole.

6250. to $\frac{1}{16}$ of an Acre, or 10 Pole.

3125. to $\frac{1}{32}$ of an Acre, or 5 Pole:

1562. to 2 Pole Equal:

And 625. Equal to one Pole.

So that when any Fraction is, repair but to these Rules, and you may see what Number of poles is equal to it: you may proportion it to half-poles, &c. for,

312 $\frac{1}{2}$ is equal to half a Pole.

156 $\frac{1}{4}$ is equal to a quarter of a Pole.

78 $\frac{1}{8}$ is equal to one eighth part of a Pole, &c.

Not onely to prove this, but also to shew you how much readier this way is, than the 100 Links, to bring it into Rods or Poles, then divide it by 160, to bring the aforesaid Measure to the one Pole Chain and 100; multiply 14' 15 by 4, it gives 56' 60; and 6' 37 multiplyed by 4 gives 25' 48, which being multiplyed one by the other, gives 1442 $\frac{1680}{10000}$: I will neglect the Fraction as being not $\frac{1}{4}$ of a Pole, and divide 1442 (the Poles in that Measure) by the sq. Poles in one Acre (160 Pole) and the Quotient is 9 and 2 over, that is, 9 Acres 2 Pole and

and a little more, as before. But how much the other way is readier than this, I leave the Reader to judge.

$$\begin{array}{r}
 56' 60 \\
 25' 48 \\
 \hline
 45280 \\
 22640 \\
 28300 \\
 11320 \\
 \hline
 1442' 1680
 \end{array}$$

$$\begin{array}{r}
 5' 0 (2 \\
 1' 4' 4' 2 (9 \\
 1' 0' 0.
 \end{array}$$

Example the Second.

How to measure a Triangle with the Four-pole Chain, and never use Division.

As in the Triangle A B C. the Base A C. is 40 Pole, and the prick'd Perpendicular Line is 20, the half is 10 Pole; Now when you have even Poles (as in this *Examp.*) you must adde two Cyphers to the length, and two to the breadth; or else you cannot take off the 5 Figures, or 5 Cyphers, as is before shewed; then taking the 5 Cyphers off after Multiplication, there remains 40: which sheweth you that such a Triangle, that hath such a Base, and such a Perpendicular, containeth four Acres of Ground: And if you work it the common way, you will find it to be true.

40' 00

10' 00

40' 00000

(See Fig. 43.)

But to assist you yet further to turn Poles into Acres, observe this Table: The Denominations of the several Numbers are known by the Marks under which they are set, as all under *Ac.* are Acres; under *Ro.* are Roods, under *Po.* are so many Pole; and so the first Column under M. answereth to Thousands, that under C. to Hundreds, that under X. to Tens, and the odde Pole (if any be) are set down under Pole: As *e. g.* 1442 Pole: To

	M.	C.	X.
	ac. ro. p.	ac. ro. p.	ro. po.
1	6. 1. 00.	2. 200.	10.
2	12. 2. 00.	1. 00.	20.
3	18. 3. 01.	3. 200.	30.
4	25. 0. 02.	2. 01.	0.
5	31. 1. 03.	0. 201.	10.
6	37. 2. 03.	3. 01.	20.
7	43. 3. 04.	1. 201.	30.
8	50. 0. 05.	0. 02.	0.
9	56. 1. 05.	2. 202.	10.

know

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know how many Acres by this Table: first for the One thousand in the Table under M. is 6 Acres one Rood, set that down as you see in the preceding Page; then four Hundred under C. and against 4 is 2

Acres 2 Roods, set that down; then in the Table under X. and against 4, is one Rood, set that down; then the odde Poles set down alwayes under the Poles, as 2 under Poles; then summe them up, and you shall find it is 9 Acres 2 Pole, as before: This Table being so plain, there needs no more Examples.

ac. r. p.

1000 gives 6. 1. 0.

400 gives 2. 2. 0.

40 gives 0. 1. 0.

2 gives 0. 0. 2.

9. 0. 2.

A Table of superficial long Measure, from an Inch to a Mile, according to the Standard of England.

Inch.					
12	A foot.				
36	3	A yard.			
45	$3 \frac{3}{4}$	$1 \frac{1}{4}$	Ell.		
198	$16 \frac{1}{2}$	$5 \frac{1}{2}$	$4 \frac{2}{3}$	Pole.	
7920	660	220	176	40	Furlong.
63360	5280	1760	1408	320	8
					Mile.

A Table of square Measure.

Acres.	4	160	4840	43560
	Rood.	40	1210	10890
		Pole.	$30 \frac{1}{4}$	$272 \frac{1}{4}$
			Yards.	9
				Feet.

An Example of the Table of long Measure.

Suppose you were to find out how many Inches were in a Pole long; look under *Inches*, and against *Pole*, there is 198; and so many Inches are in a Pole long, and $16 \frac{1}{2}$ Foot, $5 \frac{1}{2}$ Yards:

And in the Table of Square Measure, to know how many square Yards is in a Pole, look against *Pole*, and above *Yards* there is 30 $\frac{1}{2}$, the square yards in a Pole.

There be several other sorts of superficial Measures, as Pavings, Plaisterings, Wainscotings and Painting; which are to be measured by the Yard square, and may be measured by some of the Rules before shewed; your readiest way is by the Yard divided into ten parts, so will your odde Measure come into Decimal Fractions, which are as easily cast up as whole Numbers: Or if you measure by the Foot Rule, have it divided into 10 parts, and when you have found the Content in feet, divide it by 9, the Quotient will shew you how many yards; and if any remain, they be feet.

Some sorts of Work are measured by the square of 10 foot the side, so that such a Square is 100 foot; for ten times Ten is a Hundred: By this Measure is your Carpenters Work measured, as Floors, Partitions, Roofs of Houses; So also is Tiling and Slatting measured; this is very ready to measure and to cast up: for if you multiply the Breadth by the Length, so many hundreds as you find, so many Squares are there; and what remains are parts of a Square.

Board and Glafs, &c. are measured by the foot, which may be divided into ten parts; which will be much easier to count up.

But if you would be more fully satisfied in the Rules of Surveying, see the work of Mr. Leyborn, Mr. Wing, Mr. Rathborn, &c.

Having the Length of a Field, to know what Breadth will make one Acre of Ground, by the Four-pole Chain and Line of Numbers.

Ex. The Length is 12 Chains 50 Links, to find the Breadth to make that Length just one Acre, do thus: Extend your Compasses from 12⁵⁰ (the Length) to 10, that Extent will reach from one to 80, which is the Breadth in Links to make one Acre; for if you multiply 12⁵⁰ by 80, it yields 100000; from which if you take off five Cyphers, there remains one, which is one Acre, &c.

$$\begin{array}{r} 12^50 \\ 80 \\ \hline 1^00000 \end{array}$$

CHAP. XLI.

Of Measuring Holes and Borders that be under a Pole broad, by which you may the better lett or take them to doe by the Pole-square, &c. with severall Tables of Measures.

HOles for to set Trees in are feldome made under one foot Diameter, or above eight foot Diameter; the Depth may be reduced to a foot deep.

The Rules to measure any Circle by, are the same, which is thus: To take the Semi-circumference and the Semi-diameter, and multiply these Halfs, the one by the other, sheweth the superficial Content or Area of that Circle.

This you may work either by the Pen, or Line of Numbers: As by the line of Numbers thus: The Diameter being four foot, extend the Compasses from 1. to 4. (the Diameter;) keep your Compasses fixed, and alwayes on the Number 7854 set one point, and turn twice to the Right hand: (but if they fall off at the End at the second turn, then must you set them on the first part of the Line when you have turned them once, &c.

Having taken the distance of 1 to 4. and set one poynt on the standing Number 7854: the other poynt goes to 31 and neer $\frac{1}{2}$, thence if you turn another turn it will go off from the Line, therefore you must find the poynt 31 and neer $\frac{1}{2}$ on the first part of the Line, and set one poynt there, the other will reach to 12 and about $\frac{1}{2}$; which tells you, that in a Circle of 4 foot Diameter there are 12 superficial square feet and a half, and better.

Now to work it according to the Rule above, by the Line, if you multiply the Semi-diameter by the Semi-circumference, it giveth the Content, the same way I shall do it with my Pen:

Example.

First, having the Diameter I must find the Circumference; Extend the Compasses from 7 to 22. the same will reach from 4 to 12.58 (the Circumference) then $\frac{1}{2}$ of 12.58. is 6.29, the (Semi circumference) which multiply by 2 the Semi diameter: Extend the Compasses from

from 1 to 2, the same Extent will reach from 6.29 to 12.58, as before, that is, twelve foot and a half and $\frac{8}{10}$: You here may see how easily and readily the *Golden Rule* and *Multiplication* may be performed by the Line of Numbers; which I use the oftener, that you might take the more notice of the easiness of it to work any of the Rules of Arithmetick by: Being once perfect in this, you will soon understand the Sector, with its excellent uses in the Mathematicks, performed by Lines and Compasses; but according to the last Rule, see the same Question wrote with the Pen, that you may see the Agreement that is between Geometry and Arithmetick.

Example. 144

To find the Circumference, as 7 to 22 so 144 the Barly-corns in four foot the Diameter to 452.6. fe. the Circumference in Barly-corns ——— 452.6

Half circumf.	226.3	288	3.14
Half-diameter	72	288	31.6.80 (452.6
		3168	7.7.77
	4526		
	15841		

16293.6 the Barly-corns in four foot Diameter *ferè*.

To know how many foot this is, divide it by the Barly-corns in one foot, which are ——— 1296

Barly-corns in $\frac{1}{2}$ a foot 648

Barly-corns in $\frac{1}{4}$ of a foot 324

1. 74
3.9.5.
4.3.3.1
1.6.2.9.3. (12 foot 741 parts;
1.2.9.6.6.
1.2.9.

Which 741 Barly-corns is above half a foot, as was shewed before; but in finding the Circumference I adde a Cypher to 4, which makes it 40, from that I take 6 times 7, which is 42, and should be but 40, then because I took too much, I neglect 6 when I divide it by the Barly Corns in a Foot Square, so that I do not say it is exact, neither doth the Fraction $\frac{741}{1296}$ bear the like proportion as $\frac{58}{100}$ for if you extend your Compasses from 100 to 58, that Extent will reach from 1296. to 750; and if you will be more exact work it by Logarithmes, 'tis 12 foot 82 Inches.

A Table from one Foot Diameter, to 8 foot superficial Content.

One foot Diam. is 11 $\frac{1}{2}$ Inches.
 Two foot Di: is 3 foot 20 Inches.
 Three foot Di: is 7 foot 10 Inches.
 Four foot Di: is 12 foot 82 Inches.
 Five foot Di: is 19 foot 93 Inches.
 Six foot Di: is 28 foot 41 Inches.
 Seven foot Di: is 38 foot 72 Inches.
 Eight foot Di: is 50 foot 43 Inches.

Now knowing the Content of any of these Circles, you may the better know how to let or take them to doe, and reduce them into square Poles, or let them to doe by the Pole square, &c. for,

	foot,	
One superficial Pole square is	272 $\frac{25}{100}$ or $\frac{1}{4}$	16'5
Half of a square Pole is	136 $\frac{125}{1000}$	16'5
A Quarter of a square Pole is	68 $\frac{625}{10000}$	825
One Eighth of a square Pole is	34 $\frac{3125}{100000}$	990
		165
		<hr/> 272'25

For if you divide 272 $\frac{25}{100}$ by 8, you will have in the Quotient 34 $\frac{3125}{100000}$, which is one eighth part of a pole; to reduce the Inches into feet, may be easily done:

For 144 Inches is a superficial foot square.

72 half of a square foot.

36 Inches is $\frac{1}{4}$ of a square foot.

18 Inches is $\frac{1}{8}$ of a square foot, &c. for 8 times 18 is 144.

How to measure your Borders, if you let them to doe by the Rod.

Any under-measure is best to measure by the Decimal Chain, if by the one Pole Chain, and divided into 100 Links: If it be the Four pole Chain divided into 100 links, then every one of these Links is four link of the other; so that every square Rod is 10000 links superficial.

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One link broad, 10000 in length, makes a Pole.

Two links broad, 5000 long, a Pole.

Two and a half broad, 4000 in length, a Pole.

Three links broad, 334, neer a Pole.

A Table of the rest in Links from one Link to a hundred.

<i>Breadth.</i>	<i>Leng.</i>	<i>Bred.</i>	<i>Leng.</i>	<i>Bred.</i>	<i>Leng.</i>	<i>Bred.</i>	<i>Leng.</i>
1	10000	26	385	51	196	76	132
2	5000	27	371	52	192	77	130
3	3340	28	357	53	188	78	128
4	2500	29	344	54	185	79	127
5	2000	30	333	55	182	80	125
6	1667	31	323	56	178	81	124
7	1429	32	312	57	175	82	122
8	1250	33	303	58	172	83	121
9	1111	34	294	59	170	84	119
10	1000	35	285	60	167	85	118
11	909	36	278	61	164	86	117
12	833	37	270	62	161	87	115
13	770	38	263	63	158	88	114
14	714	39	256	64	156	89	113
15	667	40	250	65	154	90	111
16	625	41	244	66	152	91	110
17	588	42	237	67	149	92	109
18	556	43	232	68	147	93	108
19	527	44	227	69	145	94	107
20	500	45	222	70	143	95	105
21	475	46	217	71	141	96	104
22	454	47	213	72	139	97	103
23	435	48	208	73	137	98	102
24	417	49	204	74	135	99	101
25	400	50	200	75	133	100	100

This Table is so easie to understand, that it needs no *Example*; for look but the Breadth, and against it is the Number of Links that you must

must have in Length to make a Pole square superficial. This Table is of other excellent uses, which is left to your Practice; though it is not exact, yet it is as near as can be in whole Links; and the fractional parts are so small, they be not worth minding; but you may proportion them if you please. The last Tables of Holes, and this for Borders, I made to assist me to lett my Lords Work at *Cashbury*.

Brick-work is measured by the Pole of 16 $\frac{1}{2}$ feet long; and let the Wall be 3, 4, 5, or 6 Bricks thick, the thickness is alwayes reduced to a Brick and half thick: So that one

1 Brick $\frac{1}{2}$		3	Brick and a half thick is in proportion to 3, 2 Bricks thick to 4, &c.
2 Bricks		4	
2 & $\frac{1}{2}$		5	The Rule is this, as 3 is to any Number against the Bricks or Bricks and half, (according as the Wall is thick.) so is the Length of Poles to the Content in Poles.
3 Bricks		6	
3 & $\frac{1}{2}$	thick is in	7	
4 Bricks	proportion to a	8	
4 & $\frac{1}{2}$	wall of one	9	
5 Bricks	Brick and	10	<i>Example.</i>
5 & $\frac{1}{2}$	half thick	11	A Wall 7 Bricks and half thick and
6 Bricks	as three is	12	2 Pole long, is 10 Pole of Wall reduced to a Brick and a half thick, the
6 & $\frac{1}{2}$	to any of	13	number answering against 7 Bricks and
7 Bricks	these	14	$\frac{1}{2}$, is 15, then by the Rule of Three,
7 & $\frac{1}{2}$	Numbers,	15	with your Pen or Line and Compasses,
8 Bricks		16	work it thus: As 3 is to 15; so is 2
8 & $\frac{1}{2}$		17	(the Length of the Wall in Rods or
9 Bricks		18	Poles) to 10; so that a Wall 7 Brick
9 & $\frac{1}{2}$		19	and a half thick, and 2 Pole long, is
10 Bricks		20	equal to 10 Pole of a Wall that is but one Brick and half thick.

But if you measure the Wall by a 10 foot Rod divided into 10 or 100 equal parts, you may soon find the superficial Content in feet, by multiplying the Length by the Breadth, and so turn them into square Poles by the Table following.

Example.

272	Suppose a Wall 272 foot long, and 12 foot high, that
12	is 3264 superficial square feet; which if you divide by
272	272 and $\frac{1}{2}$ (the superficial feet in one Rod square) the
544	Quotient will be 11 and 269 $\frac{1}{2}$, that is, 11 Pole, 269
272	foot and $\frac{1}{2}$, which wants but three foot of twelve Pole
	or Rod: For if you take 269 $\frac{1}{2}$ 23, from the square feet
3264	in a Pole, viz. 272 $\frac{1}{2}$ 25, there will remain but three
	foot,

foot, as you may see it, and the Division here wrought with the Pen.

Where note in Division, that if the Divisor or the Dividend, or either of them hath a Decimal Fraction belonging to it, adde two Cyphers to the other, as you see here is done; and also in Division of Fractions, so many times as you can take whole Numbers from whole Numbers, so many whole Numbers have you in your Quotient; but when your whole Numbers come under your Fractions, what comes then in the Quotient is Fractions; and you must alwayes make a stop between the whole Number and the Fractions, in all places; and so in Multiplication, so many Fractions as there are in the Multiplicand and Multiplicator, so many Figures must you cut off from the Product.

And note, that if this 272 had been but 272 and $\frac{1}{2}$, then had there been just 12 Pole; for every foot high had then been one superficial Pole square. The use of this Table is to turn Feet into a superficial Pole square: if your summe be 10000, then take the Number answering your ten Thousands under X. M; if a Thousand under M, a Hundred under C, and Tens under X.

An *Example* will make it plain; having measured your side of a wall, and found it to be (as in the last *Example*,) 3264 feet, look under M. and against 3. there is p. 11. o. f. 5;

then look under C, and against 2, there is o. 2. 62; then under X. and against 6 is 60; and then the four odde foot set down as you see here, make neer 12 Pole, as before.

272' 25 is one Pole, square feet, superficial Measure, and 136' 125 is half a square Pole, and 68' 062' is one quarter of a Pole square, but if your summe be Ten or Tens of Thousands, then you must take that from under X. M.

$$\begin{array}{r}
 2692 \\
 3713 \\
 354255 \\
 3264' 25 \quad (11 \\
 27225 \\
 27225 \\
 \hline
 003' 00
 \end{array}$$

	X. M.	M.	C.	X.
	p. q. f.	p. q. f.	p. q. f.	p. q. f.
1	36.2.63	3.2.41	0.1.31	10
2	73.1.58	7.1.26	0.2.62	20
3	110.0.53	11.0.05	1.0.26	30
4	146.3.55	14.2.52	1.1.57	40
5	183.2.40	18.1.31	1.3.20	50
6	220.1.35	22.0.10	2.0.54	60
7	257.0.43	25.2.57	2.2.17	1.02
8	293.3.41	29.1.36	2.3.47	1.12
9	330.2.25	33.0.15	3.1.13	1.22

3000	11. 0. 05
200	0. 2. 62
64	0. 0. 64
	11. 3. 63

As for Example. In 36542 square feet, how many poles, quarters, and feet are there? You will find, if you take them out of the Table as is before shewed, and also sum them up, that there will be

	pole.	qu.	feet.
For 30000 an.	110.	0.	53.
For 6000 an.	22.	0.	10.
For --- 500 an.	1.	3.	20.
For the 40 an.	0.	0.	40.
And for the 2 an.	0.	0.	02.
	134. 0. 57.		

excellent use.

These Tables will also assist you well in Levelling of Ground, that is, if you let your Ground to be done by the pole square of 16 foot and a $\frac{1}{2}$, which is called a Floor, viz. 272' 25; but in some places the Floor is 18 foot square, and one foot deep, which is 324 solid feet; and in some places Ground is Let to dig and to carry away by the yard solid, that is, 27 solid foot; for 3 times 3 is 9, and 3 times 9 is 27, which is near a Cart load of Earth; so that in a Floor of Earth of 16 foot and a $\frac{1}{2}$ square, and a foot deep (according to this Rule) there is about 10 Loads of Earth, as you see it is 10 Loads $\frac{1}{10}$ and $\frac{1}{10}$ or solid yards. The Floor of 18 foot square, or 324 solid feet, is 12 solid yards, or 12 Loads of Earth.

Now all Banks that are made, taking down of Hills in Walks, or filling up of low places, or making Mounts, or Mount-walks, are most commonly Let by the Rod square, to do; and Reduced to one foot deep.

The price for Removing Earth is according to the Ground, for some Ground is much worse to dig than others: but that you may not be altogether unsatisfied, I have observed it thus:

The worst sort of Earth or Gravel (so it be not a Rock of stone) may be removed, where Men work for 12 d. the day, at these prices, the Workmen finding themselves Barrows or Carts, and all sort of Working tools.

For every Rod square at 16 foot $\frac{1}{2}$ the pole, and one foot deep, to carry it from one Rod to 10 Rod, and to lay the Earth they carry, level: 2 s. for one pole or floor from 10 pole to 20, 2 s. 6 d. from 20 pole to 30, 3 s. from 30 pole to 50, to carry it in Carts, 3 s. 6 d. from 50 pole to 70, 4 s. 6 d.

But

But if it be Loom, Brick, Earth, or Clay that will dig well, that they can speet with a Spade, and fill without the use of Pit-axe or Mattock, then one fourth part may be abated, &c. This Rule is sufficient considering but this, that neer *Lonaon* where Men have more wages than 12 *d.* the day, there they will look for more a Floor; and where men work for less, it may be proportioned accordingly. Thus may you compute the Charge of making Mounts, taking down Hills, making of Ponds, &c.

But to assist you yet further, observe these few plain Rules, though they may not alwayes be exact: having found the mean Length and Breadth of your Ground, or Length of your Base and Perpendicular, & you desire to go but a quarter of a Rod in length or breadth, which will content many in ordinary uses; as if a man hath digged a piece of Ground by the Pole square, that is 10 Pole and a half broad, and 21 Pole and a half long, you may count up this, or any the like Numbers thus, ten times 21 is 210, then ten halfs is 5 whole ones, and 21 halfs is 10 whole ones

and a half; and a half of a half is a quarter, which you may keep in your Memory, or set them down: so you see here they make both by the Decimal way, and this, 225 Pole and 3 Quarters.

Ten times 21 is	210	len. 21.5
10 halfs is	005	bred. 10.5
21 halfs is	010	1075
And a half of a half is	00	2150
		22575

See here an Example or two more, first demonstrated by Decimals, and then wrought the ordinary way.

Whether is 2 Rod and $\frac{1}{2}$ square, or 2 Rod and a $\frac{1}{4}$ one way, and 2 Rod and $\frac{3}{4}$ another way, more?

Example: the work in Decimals, 2.50

$$\begin{array}{r} 2.50 \\ 250 \\ \hline 12500 \\ 500 \\ \hline \end{array}$$

6.2500: 6 Rod and $\frac{1}{4}$.

For if you work by a Decimal Chain, that is, a Rod Divided into a 100 Links or parts, Multiply that in its self, it makes 10000; the half of that is 5000, which is half a Rod; a Quarter of a Rod, is 2500; and one eight part of a Rod or half a Quarter, is 1250; one sixteenth

sixteenth part is 625 square Links; and three Quarters 7500; so that two Rod and a half is six Rod and a quarter of Ground.

<i>Examp. 2 Rod and 3 quarters</i>	2'75
<i>And 2 Rod and a quarter</i>	2'25
	<hr/>
	1375
	550
	550
	<hr/>

6'1875 which is 6 Rod & $\frac{3}{8}$.

So that it appears by this, that two Rod and a half square is more than 2 Rod and $\frac{1}{4}$ one way, and 2 Rod and a $\frac{1}{4}$ another way, by one sixteenth part of a Rod; for if you add 1875, and 625 (the sixteenth part of a Rod) together, they will make 2500.

But if you work by the four-pole Chain, one Link of it is four of this.

1875
625
<hr/>
2500

The Demonstration of the preceeding Examples.

(See Fig. 44, 45.)

See these two squares counted up the ordinary way; and first, two Pole and a half by two pole and a half is 6 pole and a quarter; for mind this, if the Number of poles be even Numbers, with half a pole to each of these Numbers, that is both to length and breadth, so that such a Figure comes always off with a Quarter.

2 times 2 is 4.
2 halves is 1.
and 2 halves is 1
& half of a half;

But if one of the Numbers be odd poles, and the other even, with both length and breadth ending in half a pole, as in the first Example, then always such a Figure ends in $\frac{1}{4}$ of a pole, as that doth.

6 pole $\frac{1}{4}$

But if a Figure be two pole and $\frac{1}{4}$ one way, and two pole and $\frac{1}{4}$ the other, as the last was, it ends always in such a Decimal as this, 1875, that is half a quarter, and half half a quarter, that is $\frac{1}{8}$ and $\frac{1}{16}$ parts of a pole square.

This way may you cast up the Content of a Ground very speedily, and Exact. if the middle Length and middle Breadth fall out in $\frac{1}{4}$, $\frac{1}{8}$, or $\frac{1}{16}$ of a Pole; and this way you may summe up a Field before you do it decimally: And then one will be good proof to the other, which with little Practice will make you so perfect, that in small Fields you will readily tell the Content without Pen or Rule, only by Memory.

These

These Rules may also be done by two turns of your Compasses on the Line of Numbers; and there is no way so ready, if once you come but to understand that most usefull Line well.

For, as the distance of one of the Numbers to be multiplied, is from one at the End of your Line, the same distance is the product from the other Number.

Example of the Second Figure.

As One is to Two and a half, the same Extent of your Compasses will reach from 2 and a half to $6\frac{1}{2}$ the Product.

A Table of Board-Measure, by having the breadth of the Board in Inches, against which is shewed the Quantity of one foot thereof in Length.

The use of this Table:

Having taken the Breadth of the Board in Inches, see what Number answereth it in this Table, and what Number you find against the Breadth in Inches, multiply by the Length of the Board or Glass, and cut off the three last Figures to the Right hand: thereby you shall have the Number in feet, and the parts cut off are parts of a foot.

Example:

A Board ten Inches broad, and ten foot long; against 10 you see is 0'833, which multiplied by 10, gives 8330; then taking off 3 Figures, there re-

mains 8, that is 8 foot and $\frac{33}{100}$: But if you would measure this Board by the Line of Numbers, then set one point of your Compasses on 12, extend the other to the breadth in Inches, the same Extent will reach from

Breadth of the board in Inches.	f. pts.	Breadth of the board in Inches.	f. pts.	The quantity of one foot in Length.
	1 0'083		19 1'583	
	2 0'167		20 1'667	
	3 0'250		21 1'750	
	4 0'333		22 1'833	
	5 0'417		23 1'917	
	6 0'500		24 2'000	
	7 0'583		25 2'083	
	8 0'667		26 2'167	
	9 0'750		27 2'250	
	10 0'833		28 2'333	
	11 0'917		29 2'417	
	12 1'000		30 2'500	
	13 1'083		31 2'583	
	14 1'167		32 2'667	
	15 1'250		33 2'750	
	16 1'333		34 2'833	
	17 1'417		35 2'917	
	18 1'500		36 3'000	

from the length in feet, to the Content. [For as 12 (the side of a superficial foot square) is to the breadth in Inches, which here is 10; so is the length in feet (which in this Example is 10,) to the Content in feet and parts, which is 8 foot $\frac{10}{12}$: Note this for a general Rule, that if the Breadth be less than 12 Inches; then must you turn the Compasses to the left hand on your Rule; and if more than 12, then turn your Compasses from the Length in feet to the Right hand.

Learn but to read your Line well, and this Rule, then may you measure any Board or Pain of Glass as easily as to tell ten, &c.

CHAP. XLII.

Of measuring Timber and other solid Bodies, with several Tables usfull thereunto, &c.

IN Board, Glass, Land, &c. we only took notice of the Length and Breadth, which was sufficient to find the superficial Content; but to measure solid Bodies we must take notice of the Length, Breadth and Depth. Most of solid Figures are measured by finding first the superficial Content of the Base, or one End, and multiplying that by the Length, if both Ends alike; but if tapering, then by $\frac{1}{2}$ of the Length; and as superficial Measure hath 144 square Inches in one foot, and 72 square Inches in half a foot, and 36 square Inches in a Quarter: So

In solid Measure 1728 square Inches make one foot,

And 8.64 square Inches make half a foot,

And 432 square Inches make a quarter of a foot.

For every Inch square is like a Die, and so is a foot of solid Measure supposed to be; for what it wants either in Breadth or in Thickness, it must have in Length; so that in what form soever your solid Body is, that you measure, there must be 1728 solid Inches to make a foot; for 12 (the side of a foot) multiplied by 12 gives 144 for one side; and 144 multiplied by 12 (another side) gives 1728, the Cube-square Inches in a Cube-square foot.

Now to find the solid Content of any piece of Timber or Stone that hath the sides equal, first find the superficial Content of the End, in
Inches

Inches and parts; and multiply that by the Length in Inches, the Product is the Content in solid Inches: Then divide that summe by 1728 (the Inches in a foot,) the Quotient sheweth you the Content in solid feet, and what remain are Inches. If you would work this by the Line of Numbers, the Rule is thus:

Extend the Compasses from one to the Breadth in Inches;

The same Extent will reach from the Depth to the Content of the End:

Then extend the Compasses from one to this Content of the End;

Keep your Compasses fixed, and that Extent will reach from the Length to the Content in solid Inches.

But if your solid Figure hath both Ends alike, and in form of a Regular Polgone; that is, a piece of Timber hewed into 5, 6, 7 or 8 equal sides, &c. which is called by some *Aprisme*: then take the Semi-circumference, and multiply that by the *Radius* or Semi-diameter, that product by the Length giveth the Content.

But if your solid Figure be a Cylinder, that is, a round piece of Timber or Stone; having both Ends equal Diameter, as a Roller, &c. here take the Semi-circumference, multiply it by the Semi-diameter, and the *Area* of that by the Length giveth the solid Content.

Now many of the Bodies of our Timber-trees will be near this form of a Cylinder, but Custom hath got such footing (though very false,) that men will not measure their Timber the true way, but will still keep their Error, which is, to gird the middle of the Tree about with a Line, and take the fourth part thereof for the true square, and so measure it as a four-square piece of Timber; but how false that is, may appear by the ensuing Tables. Whoever is pleased to trye, will find, that there may be four Slabs taken off, to bring that to a Square, and that squared piece then will be near equal to the Measure they first measured the piece of Timber by; so that when they have brought their piece square by hewing or sawing, they then have the Measure that it was measured for when it was Round.

But several men have demonstrated this false Rule to be false near, as Mr. *Wing*, Mr. *Philips*, and others: Yet Custom doth and will keep its Road.

I have already shewed how to measure Timber by the Customary way, by the Line of Numbers, in *Chap.* 35, and 36. before-going, and for further satisfaction I referre you to these Tables following.

A Table shewing the solid Content of one foot Length, of any piece of Timber according to the superficial Content taken at the End thereof.

	f. pts.	In-End	f. pts.
1	0.007	200	1.389
2	0.014	300	2.083
3	0.021	400	2.778
4	0.028	500	3.472
5	0.035	600	4.167
6	0.042	700	4.861
7	0.049	800	5.556
8	0.056	900	6.250
9	0.062	1000	6.944
10	0.069	2000	13.888
20	0.139	3000	20.833
30	0.208	4000	27.778
40	0.278	5000	34.722
50	0.347	6000	41.666
60	0.417	7000	48.711
70	0.486	8000	55.555
80	0.556	9000	62.500
90	0.625	10000	69.444
100	0.694	20000	138.888

The Inches at the End.

Finding the superficial Content at the End of your Timberstick or Stone, &c. let it be Round or Square, so it hath but the same Compass from one end to the other, against that Number is the feet and parts of one foot Length; and by multiplying that by the Length of your Stick, sheweth the Content in square feet.

Example:

The superficial Content at the End being 200 Inches and 5 foot long, against 200 is 1 foot 389 parts,

1.389 which multiplied by 5 (the Length,) yieldeth 6 foot and 5 945 parts, that is near 7 foot of Timber: But if the Number that is at the End be not in the Table, then add two 6.945: Numbers together, and then take the Number which answereth them, and add them together, and multiply the Length by that summe, as before, &c.

A Table shewing the true Quantity of one foot length, in any true squared piece of Timber, for Inches and half Inches, from half an Inch square to 36 Inches square.

I.	fo. pts	I.	fo. pts	I.	fo. pts	I.	fo. pts	I.	fo. pts	I.	fo. pts	I.	fo. pts
1	0'002	7	0'293	13	1'085	19	2'377	25	4'166	31	6'460		
	0'007		0'340		1'174		2'507		4'340		6'673		
	0'016		0'390		1'266		2'641		4'513		6'890		
2	0'028	8	0'444	14	1'361	20	2'778	26	4'694	32	7'111		
	0'049		0'502		1'460		2'918		4'877		7'333		
3	0'062	9	0'562	15	1'562	21	3'062	27	5'063	33	7'562		
	0'085		0'627		1'668		3'210		5'250		7'780		
4	0'111	10	0'694	16	1'778	22	3'361	28	5'445	34	8'028		
	0'140		0'765		1'891		3'516		5'670		8'263		
5	0'174	11	0'840	17	2'007	23	3'673	29	5'840	35	8'507		
	0'210		0'919		2'127		3'835		6'043		8'750		
6	0'250	12	1'000	18	2'250	24	4'000	30	6'250	36	9'000		

If you would enlarge this Table further, the Rule is this;
As the square of 12 Inches (which is 144) is to 1000,
So is the square of another Number to another.

Example.

As in 36; the Square of it is 1296; then as 144 is to 1000,
So is 1296 to 9 foot, &c. as is in the Table.

The Use of the Table.

The Square of a piece of Timber being found in Inches,
and the Length thereof in Feet, to know the Content, take
the Number answering to the Square of Inches, out of the
Table, and multiply it by the Length in feet.

Example.

A piece of Timber 18 Inches square, and 25 foot long;
the Number answering to 18 Inches square, is _____

Which multiplied by 25 (the Length)

Which is 56 foot and one quarter.

A piece 18 Inches square at the End, and one foot long,
is 2 foot and $\frac{1}{4}$.

36
36
216
108
1296

2.250
25
56.250
11250
4500
56.250

A Table shewing by the Compass of Round Timber, what is contained in a Foot length thereof.

Co.	fo. pa.	Co.	fo. pa.	Co.	fo. pa.	Co.	fo. pa.	Co.	fo. pa.
10	0'055	28	0'433	46	1'169	64	2'264	82	3'715
11	0'066	29	0'455	47	1'220	65	2'335	83	3'807
12	0'079	30	0'497	48	1'273	66	2'406	84	3'866
13	0'093	31	0'531	49	1'327	67	2'480	85	3'990
14	0'108	32	0'566	50	1'381	68	2'555	86	4'084
15	0'124	33	0'602	51	1'437	69	2'631	87	4'183
16	0'141	34	0'639	52	1'496	70	2'707	88	4'279
17	0'159	35	0'677	53	1'552	71	2'785	89	4'377
18	0'179	36	0'716	54	1'612	72	2'864	90	4'475
19	0'200	37	0'756	55	1'671	73	2'945	91	4'576
20	0'221	38	0'798	56	1'732	74	3'026	92	4'677
21	0'243	39	0'840	57	1'795	75	3'108	93	4'780
22	0'267	40	0'884	58	1'860	76	3'191	94	4'882
23	0'292	41	0'929	59	1'923	77	3'276	95	4'987
24	0'318	42	9'574	60	1'988	78	3'362	96	5'093
25	0'343	43	1'021	61	2'056	79	3'449	97	5'200
26	0'374	44	1'070	62	2'124	80	3'537	98	5'307
27	0'403	45	1'119	63	2'193	81	3'625	99	5'416

The Use of this Table is as followeth:

Look for the Compass of the Tree in Inches, and in the Column annexed you have the Quantity of Timber in one Foot length; which multiply by the Number of feet that the Tree is in Length, and the Product is the Content thereof.

1'220

12

2440

1220

14' 640

Example.

The Circumference or Compass of a Tree 47 Inches, and 12 foot long; the Number against 47 Inches is, 1'220: So there is so much in one foot Length, Which multiplied by 12 gives the Content, That is, 14 foot and above half a foot.

This

This Table shews how many Inches in Length make one Foot of Timber, according to the Compass of the piece of Timber, from 10 Inches Compass, to 100 Inches Compass.

Co.	In. pts	Co.	In. pts.	Co.	In.pts.	Co.	In.pts	Co.	In.pts
10	217'15	28	27'697	46	10'262	64	5'301	82	3'230
11	179'46	29	25'820	47	9'830	65	5'140	83	3'152
12	150'80	30	24'127	48	9'425	66	4'985	84	3'078
13	128'49	31	22'595	49	9'044	67	4'837	85	3'006
14	110'79	32	21'205	50	8'586	68	4'696	86	2'935
15	94'312	33	19'935	51	8'349	69	4'561	87	2'869
16	84'822	34	18'784	52	8'030	70	4'432	88	2'804
17	75'137	35	17'736	53	7'730	71	4'308	89	2'742
18	67'020	36	16'755	54	7'447	72	4'198	90	2'681
19	60'151	37	15'862	55	7'178	73	4'075	91	2'622
20	54'285	38	15'038	56	6'924	74	3'965	92	2'566
21	49'228	39	14'276	57	6'684	75	3'861	93	2'511
22	44'865	40	13'572	58	6'455	76	3'760	94	2'458
23	40'904	41	12'916	59	6'238	77	3'663	95	2'406
24	37'690	42	12'310	60	6'030	78	3'569	96	2'356
25	34'743	43	11'744	61	5'836	79	3'479	97	2'307
26	32'122	44	11'211	62	5'649	80	3'393	98	2'261
27	29'787	45	10'723	63	5'471	81	3'310	99	2'216
								100	2'171

The Use of this Table.

Having taken the Circumference of the Tree in Inches, look that Compass in the Table, and against it you may see how many Inches or parts of an Inch make one Foot of Timber; then with a Ruler or a pair of Compasses (which are better.) measure how many times you can find that in the Length of the piece of Timber, and so many Foot is in that piece of Timber: This is a most usefull Table to measure your Timber-trees by.

Example.

The Compass of a Tree being 84 Inches about, then three Inches and $\frac{7}{8}$ make one Foot; take with your Compasses three Inches $\frac{7}{8}$ from off a Scale, and so many times as there is that Length in your Tree, so many foot of Timber are there; &c.

If any Tree be above 100 Inches Circumference, then take half that Circumference, and find the Number belonging thereto in the Table, then take one fourth part of it, and that makes one foot of Timber: Suppose a Tree to be 146 Inches about, the half of it is 73, against this in the Table is 4 Inches 075 parts; one quarter thereof, (*viz.* one Inch 019 parts) makes one foot of Timber at that Circumference.

These Tables, with what hath been before said, will be sufficient to measure any Cylinder by, and how to measure a Cone I have shewed already. A Cone is such a Figure as the Spire of a Church, having a Circular Base, and ending in a sharp point. It is measured by the superficial Content of the Base, multiplied by one third part of the Altitude or Length. A Pyramid, or Pyramis, is such a Figure as hath an angular Base, and ends in a sharp point, which is measured as the Cone is. A Sphear or Globe, is a solid Figure, every where equally distant from the Centre; it is measured by cubing the Diameter, and multiplying that by 11, and dividing that product by 21, the Quotient sheweth the solid Content of the Sphere.

There be several other sorts of solid Figures, as several parts of the Sphear, but they all depend on the proportion of a Circle, and its Diameter.

Also the *Hexaedron*, which hath 6 Bases; *Octaedron* 8 Bases; *Dodecaedron* 12 Bases; and several other; which to name I shall forbear.

CHAP. XLIII.

Of the Oval, how to make it, and how to measure it, with other Observations thereon.

HAVING the Length and Breadth of the Oval given you, you may take the whole Length and half the Breadth, as is shewed before in bringing three Pricks into a Circle, and from the Centre of these three poynts draw half the Oval, and so likewise the other half, as you see the Oval in the Figure drawn; for the poynt F. is the Centre of the Arch A B C, and the Arch A G C is made by the same Rule, and
where

where the Line *FH*. crosseth the Line *AEC*, as at *K*, there is the Centre of the breadth *BG*, and the End *A*; from the Centre *K* may you make the Ends of your Oval Round as you please; so that from four Centres you may make the Ends of your Oval round as you please; but if they be made from two Centres, as that is, then will the Ends be more Acute.

Or you may make your Oval thus: Having resolved on the breadth, draw the sides from Centres in the Mid-line of the breadth, as before; then set up two sticks exactly in the Mid-line of the Length, at equal distance from each End, then hold the Line at one, and turn the Line to the side of the Oval, and then on the other side the stick, with the same length, so may you make the Ends of your Oval as Round as you please; for the nearer you place these sticks in the Centre of the length and breadth of the Oval, the nearer Round your Oval is made, even till you come to a Circle: This way your Ingenious Work-men make their Ovals in small works, as your Plaisterers, Joyners, &c. and it is a good way, and so common that I need not say more to teach how to make an Oval of any bigness; but here I shall take occasion to shew the Figure of one at *Cashibury* now made.

(See Fig. 46.)

To measure this Oval, which is 28 Rod long, and 19 Rod broad, as 'tis now staked out at *Cashibury*, intended for a Kitchen-Garden: This Oval being made of 2 Segments of a Circle whose Semi-diameter is 15 Rod, as 'tis found by making the Oval; it being the Centre-poynt of each Arch-line of this Oval, as the lines *FA*, *FB*, and *FC*.

Now, to find the length of one of these Arch-lines, is shewed before; which I find to be 18 Rod, the half length of one, which is shewed by the line *DD*. so the whole length of one Arch is 36, and both Arches round the Oval is 72 Rod.

Now, take the $\frac{1}{2}$ of one of the Arch lines, which is 18, and the Semi-diameter of that Arch, which is 15 Rod; Multiply the one by the other, and it is 270 Rod, which is the Figure *A. B. C. F.* that is half of the Oval; and the Triangle *A. F. C.* which must be subtracted out of the 270, then the Semi-Oval will be 192 Rod.

For the Base *A. C.* is 28 Rod, which is the length of the Oval; and the Perpendicular of the Angle, which is *EF*. is 5.57.

Now, half the Base (which is 14) Multiplied by

18
15

90
18

270

Aa

the

the whole Perpendicular 5¹¹ gives 77⁹⁸, which is 78 Rod *ferè*:
 this taken from 270 (the Area of the Figure A. B. C. F.) there then
 remains 192 Rod, which is half

5 ⁵⁷
14
—
2228
557
—
7798

of the Oval; that doubled is
 384 Rod, which being Divided
 by 160, sheweth that the Con-
 tent of this Oval will be 2 Acres
 and 64 Rod.

270
78
—
192
192
—
384

But if your Oval be round at
 the end, as your Ovals are that
 be made with 4 Centres, then

they be more difficult to be Measured; however
 these Rules are sufficient.

1 ⁶ (64
3 ⁸ 4 ²
1 ⁶ 0

An Oval is no ill Figure for a Garden; for if the
 Garden-wall be an Oval, and the length of the Oval

point North and South, as the afore-mentioned Oval doth (A. being
 the South point, C. the North) then may such a Wall be Planted with
 Trees, both in-side and out-side, and have never a Tree stand to the
 North Aspect; for if you make your going in at the South end of your
 Oval, then will those 2 Trees or Tree that stood on the in-side, or were
 to stand there, be removed from the North aspect to the North-East,
 and North-West, according to the largeness of your Gate; so will
 every 2 Trees on the in-side of your VVall tend nearer the South-point,
 till they come to the point C. which is South; and then the Trees on
 the out-side, every 2 Trees will fall nearer the North-point at C. till
 you leave that point of the Oval between 2 Trees, so will not one Tree
 stand to the North aspect, and but few near the North aspect; the like
 whereof no other Figure can do, that I can think of.

An Oval with the ends pointing East and VVest is no ill Figure for a
 Garden; for the walls in this, as in the other, are not so subject to
 oppose the winds as straight walls be, therefore not so blasting, as you
 may well conceive.

2. Ovals on each side the Front of your House, would be no ill
 Prospect, but in many things very convenient; these being at equal
 distance from the middle of your Front, and poynting upon your
 Lawn, &c.

CHAP. XLIV.

Suppose you have a Plat to draw on one or many Sheets of Paper, and you would draw it as large as the Paper will bear; to know what Scale you shall draw it by.

IF it be a sheet of *Dutch Paper*, about 21 Inches long, and the length of the Draft you would draw is 402 foot long, and you would draw it as large as you can on this sheet, that your work may shew it self the better, and yet not to go off of the Paper; now to know of what Scale of so many parts in one Inch to draw your Draft by, do thus: Divide the Length of your Draft by the length of your Paper, and the Quotient shews how many parts that Inch must be divided into, to draw this Draft by; as,

Example.

402 divided by 21, gives in the Quotient 19 and 3 over; so then, you may draw this Draft on this Paper, which is 21 Inches, by a Scale of one Inch divided into 19 parts.

$$\begin{array}{r} 21 \overline{) 402} \\ 42 \end{array} \quad (19$$

$$28$$

$$402 \quad (19.$$

$$21$$

$$3$$

The Inch into 19 parts

& $\frac{3}{21}$ over.

But if it be a sheet of ordinary Paper, of 16 Inches long, and you would draw the same Draft on it, though in a less Form, then divide 402 by 16.

$$\begin{array}{r} 16 \overline{) 402} \\ 32 \end{array} \quad (25$$

$$28$$

$$402 \quad (25:$$

$$166$$

$$1$$

The Inch into 25 parts will suit best with this Paper.

So that for a sheet of 16 Inches long, a Scale of one Inch divided into 25 parts. will serve to draw your Draft by on such a Paper.

But if it be required to draw the Draft of a Garden, or the like, on a quarter of a sheet of Paper, then observe the ensuing Directions.

(180)

As suppose I were to draw the Draft which is now the Garden at *Cashbury*, the Length of the Garden is 402 foot, and this quarter of a sheet of Paper is 7 Inches long; I divide 402 by 7, and the Quotient is 57 and almost a half, viz. 57 and $\frac{1}{2}$:

$$\begin{array}{r} 5 \quad (3 \\ 702 \quad 57 \\ 77 \end{array}$$

But finding this Scale to be so small, and also a Number (viz. 57.) whereof I cannot take the half; I likewise finding that my Paper will bear 7 Inches and a half in length, I divide 402 the length of the Garden by 7 and $\frac{1}{2}$, the length of this Paper, and find the Quotient to be 53 and a half, and better.

$$\begin{array}{r} 4 \\ 26 \quad (45 \\ 875 \\ 402 \cdot 00 \quad (53: \\ 7 \cdot 800 \\ 78 \end{array}$$

'Tis 53 and $\frac{45}{100}$ wrought Decimally.

This Scale being yet so small, I take the half of 54, which is 27, remembering that every one of these 27 parts in the Inch, is two foot on my Paper.

(See Fig. 47.)

The pricked Lines shew the top of every Slope.

The two Mounts A A. are to be set with Trees, so are the tops of all the Slopes where the pricked Lines be, but being not yet set, I shall not shew them.

The Walks marked with O. are to be Gravel.

The Circle B. is intended for a Fountain.

The Letter C. sheweth where the Orange house is.

The Letters g g. shew one Front of the Dwelling-house.

The rest Grass.

This is only as it is intended to be, &c.

CHAP.

 CHAP. XLV.

To find what Scale a Plat or Draft is drawn by, the Content of the Ground being given.

Suppose a piece of Ground or Field to be 30 Acres. and I measure this Plot by a Scale of 10 in the Inch, and by that Scale it makes but 17 Acres and 3 Roods, or 17 Acres and $\frac{3}{4}$; now the Question is, What Scale was it drawn by? The work is somewhat difficult by natural Arithmetick, but by Artificial, and the Line of Numbers more easie.

Example, by that excellent Table the Table of Logarithmes.

First find out the mean proportional Number between the true quantity of Acres (*viz.* 30.) and the Quantity of Acres found by the supposed Scale (*viz.* $17\frac{3}{4}$) which you may do thus: Adde the Logarithmes of these two Numbers together, the half of that summe is the *Log.* of the mean Proportional required; as thus:

The Log. of 30 is 1.47712

The Log. of $17\frac{3}{4}$ is 1.24919

The 2 summes added together 2.72631

The half of the Log: 1.36315

The Number answering to
this Logarithme is 23.08

This Number is the mean proportional Number of 30 and $17\frac{3}{4}$:

Having thus found the mean proportional Number to be 23.08, the Rule in the Second place is thus:

As the Log. of this 17 Acres $\frac{3}{4}$, found by the supposed Scale, is to the Log. of the mean Proportional (23.08) of the true Quantity of Acres, and the supposed Quantity, so is 10 (the supposed Scale) to the true Scale; as thus:

The

The Logarithme of $17\frac{1}{2}$ is 1.24919

The Log. of $23\frac{1}{10}$ is 1.36315

The Log. of 10 is 1.00000

1.11396

The Number answering this Logarithme is 13 ; which tells me that the true Scale that this Plat was drawn by, is a Scale of one Inch put or divided into 13 parts.

The way to work the *Golden Rule*, or *Rule of Three* by Log. is, to adde the Log. of the third Number and second Number together, and to substract the Log. of the first Number, and then the Number answering the Log. that remains after Substraction, is the fourth Number.

But here I have made no Addition, but substracted the first Number out of the second and third, which is all one in Operation.

How to work the same Question on the Line of Numbers.

Having found the Poynt on your Line, which is 30, and the Poynt representing $17\frac{1}{2}$, find out the poynt which is the midst between these two; and that very poynt is the Mean Proportional between these two Numbers; which here is 23 and better; for if you set one poynt of your Compasses on $23\frac{1}{10}$, that Extent from thence to 30 will also reach from that to $17\frac{1}{2}$.

Then (as before is shewed) say, as $17\frac{1}{2}$: is to $23\frac{1}{10}$.

So is 10 to 13 (the true Scale sought:)

Therefore extend your Compasses from $17\frac{1}{2}$: to $23\frac{1}{10}$, that Extent will reach from 10 to 13.

Thus you may see how readily this Question is wrought by Log. without Multiplication or Division, and also by the Line of Numbers, with two turns of your Compasses.

Example Second.

If a piece of Ground, or the side of a House be 100 Acres, Rods, or the like, and you measure it by a Scale of 12, and find it to be but $56\frac{2}{3}$, if you would know what Scale, in proportion to this, the Draft or Plot was drawn by, then work by the aforesaid Rules thus:

Find the Mean proportional Number of 100 and $56\frac{2}{3}$ thus, by taking the half of them 2 Log. and the Number answering that, is the Mean proportional Number, as thus:

Loga-

(181)

Logarithme of 100. is	2.00000
Log. of 56.22 is	1.74989
74 ^{1.58} the mean Proportional	1.87494
Log. of 12 is	1.07918
Added	2.95412

The Number answering this Log. 1.20423

Now the nearest in whole Numbers is 16, which is the Scale by which the Draft or Plot was drawn.

This also you may work by Gunter's Line, as is before shewed; for if you take the middle point between 100 and 56.22, you will find it to be near 75; for if you set one point on or near 75, and extend the other to 100, that Extent will reach from 75 also to 56.22; so that 75 is the mean Proportional Number between them two.

Then if you extend your Compasses from 56.22, to 75, that Extent will reach from 12 (the supposed Scale) to 16, the true Scale: thus having shewed you several hints of this Line of Numbers, I will here shew a few more.

CHAP. XLVI.

The Description of the Line of Numbers, or Gunter's Line.

THIS Line commonly on your two foot Rule is in two parts, and each of these two parts divided into 9 unequal parts, which be called Primes, or Integers, or whole Numbers, and are distinguished by these Figures; the first part to the left hand hath 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10: Now this Middle one, which I call 10, is also but one, as the line may be read: and then the second part to the Right hand is also 1, 2, 3, 4, 5, 6, 7, 8, 9, 10: Now this last part I shall for distinction call the Second Part, and then each of those Integers from the first one to the middle, is subdivided into 10 unequal parts, and from the middle one to 10 at the end of the Second part, between eve-

ry two Figures, according to the same order that the other were divided into 10 parts; and each of these 10 parts should be divided into 10 parts more, if the Rule were long enough to bear them; but on every two-foot Rule that hath this line well made on it, they be from the Middle one, to two in the Second part, first divided into 10 parts, and then each of these into 10 other parts; and were the Rule long enough: these should be divided into 10 other parts; but to read a summe of a Thousand, you must estimate or ghesse at the Unite, so that you may read any summe under a thousand, expressly, from the first one to 10; in the Second Part you may read 199 expressly, the middle one being 100, then 9 tenths is 90, and 9 tenths of them tenths is 9, that is, 199; which is the Division next to 2 in the second part of your Rule.

By this you may observe, that the longer your Rule is, the more exactly you may number or read a great summe, especially if you understand Arithmetick; as may be seen more fully in the Rules of Arithmetick following.

CHAP. XLVII.

Numeration on the Line, or to read a summe on the Line of Numbers.

YOU may observe, that the Figures on this line, as in the preceding Chapter, are, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; Now the same poynt or Division on the Rule, which hath 1; 2, 3, 4, 5, &c. may be read 10, 20, 30, 40, 50, &c. or they may be called 100, 200, 300, 400, 500:

By this you may perceive, that the larger Numbers you have to number, any of those Figures will admit of a larger Denomination; so that if you be to read any summe from one to 10, you have it in the Second part, for then the first one is one tenth, the middle one is one, the End one is 10; but if you be to read a Number of three Figures, (as any is under 1000) then the first one is 10, the middle one 100, the End one 1000.

Example.

Example.

To find 144, I take the middle one for the 100, then 4 of the great Divisions forward for 40, then 4 Divisions (forward still to the Right hand) for 4, and that poynt is 144, which may also be called fourteen and $\frac{4}{10}$, or 1450, or 14500; then must the middle one be 10000, and 4 tenths forward, 4000; and 5 tenths forward, 500; this poynt wants but five small Divisions of the long poynt, which is 15, or 150, or 1500, or may be 15000, according as your summe is in greatnes.

Example.

To find the poynt 12; first I read the middle one 10, then 2 tenths forward for 2, that is the poynt 12, where (in many Rules) there is a Brass Pin, because it is a Poynt much used, as you will find hereafter; now this poynt 12, is also 120, or 1200; for the first one being one, then the middle one is 10, and two tenths forward is the poynt 12, &c. but if you read this poynt 120, then the first one is 10, the middle one 100, and two tenths forward 20, which is 120; and if it be read 1200, then the middle one is 1000, and two tenths forward 200, which is 1200, &c.

Example.

To find the Number 1728, being the Cube-Inches in a foot of Timber; the middle one is 1000, then 7 tenths forward is 700, and two tenths of them forward is 20; Now the Divisions on the Rule do not shew the 8 that remains, therefore you must estimate the place for 8, which is almost one tenth more; so having found that place, 'tis the poynt which is for 1728; so, in many great summes, you must estimate or ghes at the Unite, but Decimal summes do shew themselves more plainly, as you may well perceive hereafter, especially when they end with a Cypher or Cyphers.

I hope you now plainly see the use in Reading, or numbering any summe, under 10000; and that you see also, that this is a Decimal Line, and is taken from that excellent Rule of Decimals, the Canon of Logarithmes; and that you may read any Decimal Fraction, as one tenth, one of 100, or one of 1000, or $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, or $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, &c. that is, if the Integer be in 10 parts, you may find out any of these parts; or if in 100 parts, you may find out any part from one to 100 readily.

Ex. If the Integer be 10, that is if 10 make one foot, yard, pound, or the like, I would know the poynt of one and $\frac{1}{10}$, or one and $\frac{1}{100}$; take either the middle one, or the first one, extend the Compass poynt to 5, which is the longest Division between 1 and 2, that is, the poynt of one and 5 tenths, or one and a half.

Example.

If it were required to find the point of $100 \frac{1}{100}$, or 100 and half, 'tis the same point, or it is 1000 and a half.

Example.

If it be to find the point of 60 of 100, then the middle one is the 100, and the figure 6 in the first part is the figure that is 60 of a 100, or, $\frac{60}{100}$, or as decimal fractions commonly are writ 60, the prick before, shewing it to be a decimal fraction.

Example.

To find 1560, take the middle one for 1000, and five tenths for 500, and 6 tenths of them tenths for 60, which is the point 1560 &c. Also if it be desired to find the fraction 1560, of 10000, that is the same point, and may thus be writ $\frac{1560}{10000}$; or it is the point that represents the fraction $\frac{156}{1000}$ &c. Be perfect to read the Line well, then will the other Rules be easie.

CHAP. XLVIII.

Addition on the Line of Numbers.

THe Rule is, first find one of your numbers, then count so many as the number or numbers are forward, that is to the right hand, and that is the Sum. Take notice that your sum or sums mult (if they be fractions) be Decimal fractions.

Example, In whole numbers, 55 and 15, first find 55, then count 15 forward, and the point is 70; for adde 5 to 55 it maks 60, and count 10 forward, the poyn't is 70.

Example, In 3 whole numbers 60, 57 & 35; first find 60, then 5 tens forward is 110, and 7 of a tenth, 'tis then 117, then from that point count 35, and the point or Division sheweth 'tis 152.

Example, A whole number and a Decimal, as 6 and $\frac{9}{10}$. find 16 on either part of your Rule: then count 9 of the 10 Divisions, that is between 6 & 7, which is one Division short of 7, and that is the point, which is 6 and 9 tenths, or thus 6 $\frac{9}{10}$, or 6' 9; it also may be read 6 $\frac{9}{10}$ for tis the point of that also.

Example, 2 whole numbers and 2 fractions, as 60, 80, and 70 $\frac{5}{10}$; take 60, and count 7 tenths forward, which is at the point $\frac{130}{10}$.

Note

Note here the middle one being read 100, then 3 tenths forward are for 30; then for the 80 and 50, which is 130, I count one tenth more, which then is 131, and being the Divisions on the Line fall so close, you must estimate or guess the $\frac{1}{10}$, or 'tis but adding the 2 last figures together, and keep the unite in your minde, to add to your other sum, and so you may be exact; add 50 and 80 together, it makes 130, keep 30 in mind as in this *Example*, I neglect the 2 Cyphers and add 8 and 5 together, which is 13, or add 80 and 50 make 130; now them 2 Cyphers added together make but one Cypher added to 13, is 130; that is, one Integer, and 30 of another; but if the 80 and 50 had been only 8 and 5, then 10 had been the Integer, and the 3 had been $\frac{3}{10}$ of one; and note this, that if the Integer, or whole sum that the fraction belongs to, in Decimal fractions, I say, if the Integer be 10, then from one to 10 is the Decimal fraction of that; and if the Integer be a 100 then from one to a 100 is the Decimal of that; if a 1000, then from one to a 1000, the Decimal of a 1000 may be; and so of greater sums: so that in Decimals there is no improper fraction, as is in your vulgar fractions, for there you may find the denominator more than the numerator if the fraction be a proper fraction, but if an improper fraction, then the Denominator less than the Numerator; as may be seen at large in most books that treat of fractions; see Mr. *Wingates Arithmetick* natural: so that decimal fractions may be expressed without the denominator by fixing before the decimal or broken number propounded, as $12\frac{3}{10}$ is thus, 12'35; and $2\frac{9}{10}$ thus, 2'98 &c. or $2\frac{1}{2}$ or $2\frac{1}{2}$ may thus be writ, and is in Decimals writ 2'5, that is 2 and a half; for in this *Example* the Integer is 10, and then 5 being half 10, so 'tis 2 and a half. I have been large on this Rule, because I would write to those that do not know any thing of these Rules, as well as to those that be well versed in them; my desire is to learn the one, and to shew the other that which I could never see yet in any Book, viz. new *Examples*.

CHAP. XLIX.

Subtraction on the Line of Numbers.

THe Rule is, first find the point which the great Numbers make, then count the least number from that point, towards the left hand, the Remainder is the other Number.

B b 2

Example.

Example of two Numbers, as 12 from 144, first I find 144, there I set one point of my compass, and count to the left hand 12; then reading the point that remains, I find it to be 132.

Example, of 3 Numbers; suppose you were to subtract 8 and 19 from 800, add 8 and 19 together, which is 27, then find the point 800, then count 2 tenthes and 7 of ten from the point 800, to the left hand, this sheweth the point 773, which is the Question: This rule is seldom used on the Line, therefore I shall say no more of it, but come to the most useful rules on the Line, viz. Multiplication, Division, the Rule of 3 &c.

CHAP. L.

Multiplication on the Line of Numbers.

THIS Rule is thus; Extend the Compasses from 1 to one of the numbers to be Multiplied, the same Extent will reach from the other number to the content.

Example, If you be to multiply 6 by 8; extend the Compasses from one to 6, keep the Compasses fixed, and that same Extent will reach from 8 to 48, the Content; or if you set one point of your Compasses on 1, and extend the other to 8 at that extent, if you set one point of your Compasses on 6, the other point will reach to 48, the content; as was before described.

Note that your *Rule* must be divided into 10 equal parts, and these 10 parts each of them into 10 other equal parts; thus will your foot be divided into a 100 equal parts, and thus must your yard, pole, &c. be divided; then will these parts answer the Line of Numbers which is a decimal line.

Example 2d. If a stone or board be 14 Inches broad, and 30 Inches long, how many Inches are there in that stone, board, &c? Extend the Compasses from 1 to 14, the same extent will reach from 30 (the length) to 420, the content in superficial Inches.

But if you would know how much of this breadth will make a foot square of board, glass, or stone, the rule is this; as the breadth in Inches is to 144 the superficial Inches in one foot, that Extent will reach from

from one to the length of one foot in Inch-measure.

Example 3d. Set one point of your Compasses on 14 (the breadth,) extend the other to 144; that extent will reach from one to 10 and near $\frac{1}{2}$, and so much makes a foot long, at 14 Inches broad, superficial Measure: To prove this, if you multiply 14 by 10 $\frac{1}{2}$, the product will be 144 $\frac{1}{2}$; so it is but 2 of 10, or one fifth part more.

But the most customary way to measure Board, Glass, Stone, or any thing that is measured by superficial Foot-measure, is, by Inch-measure and Foot measure together. And the Rule is this: As 12 (the side of a foot square) is to the breadth in Inches, so is the Length in Feet or Parts, to the Content in Feet or Parts.

Example 4. Shall be in the aforesaid Example, to make the Rule more plain: Set one point of your Compasses alwayes on 12, extend the other to the breadth in Inches, which is 14, that Extent will reach from two foot and a half (which is 30 Inches) to near 3 foot, viz. to two foot $\frac{1}{2}$, and better, as before.

But note, if the Breadth in Inches be more than 12, as in the last Example, then must you turn your Compasses from the Length in feet and parts to the Right hand; but if the breadth be less than 12 Inches, then must you turn your Compasses from the length in feet to the Left hand: And because this Rule is the most used, see another Example, for this way most men do measure by.

Example 5. A Board ten Inches broad, and 6 foot long, how many foot are there in that Board? Extend your Compasses from 12 (the standing number) to 10 (the breadth in Inches,) that Extent will reach from 6 the length in feet (to the left hand) to 5 the Content in feet; for as 12 is to 10, so is 6 to 5.

Thus having shewed some Examples in superficial measure in Multiplication, here I shall shew a few Examples in solid Measures; and first know, that you must take the superficial Content of the Base or End of the piece of Timber or Stone, &c. whether it be Round, Square or Triangle, which you may do by Multiplication, as is before shewed; then multiply the Content of the Base by the Length of the piece, and the product giveth the solid Content of the piece.

Example Sixth. A piece of Timber 14 Inches Broad, and 10 Inches deep and 30 Inches long, how many square Inches in that piece of Timber?

Set one point of your Compasses on one, extend the other to 10 (the depth;) that Extent will reach from 14 (the breadth) to 140, the Content of the Base.

Then set one point of your Compasses on one, and extend the other

to 30 (the Length,) that same Extent will reach from 140 (the Content of the Base,) to 4200 the solid Content of the piece in Inches.

But if you would find the Content of this piece of Timber, or any other, in feet and parts, you may do it thus: Find the Content of the Base, as before; then as the square inches in a foot (*viz.* 1728,) is to the Content of the Base, so is the length in Inches, to the Content in feet and parts.

Example 7. How many feet and parts are there in the piece of the last Example, which was 14 Inches broad, and 10 Inches deep, and 30 Inches long; having found the Base, as before, to be 140, then extend the Compasses from 140 to 728, that same Extent will reach from 30 (the Length in Inches) to two foot and neer a half, *viz.* to two foot, 744 Inches; you must turn your Compasses from 30, towards the left hand.

But if you desire to know how much in length makes a foot, then the Rule is thus: As the Content of the Base is to 1728 (the Inches in a foot square) that same Extent will reach from 1 to the Number of Inches or parts which will make a foot at such a Length.

Example 8. Of the same piece of Timber mentioned in the last Example; the Base you may find (as before) to be 140, then extend the Compasses from 140 (the Base) to 1728, (the Inches in a foot square) that same Extent will reach from 1 to 12, and little more than $\frac{1}{3}$; for if you multiply 12 $\frac{1}{3}$ by 140, the product will be 1729, which is but one more than the Inches in a foot. And here you may note the Error that many men commit in adding the Breadth and Depth together, and take the half of that summe for the true square; and the more the sides differ, the more they be mistaken.

The same Error is daily committed by those which measure Timber; for they take the Circumference in the middle of the piece of Round Timber, and one fourth part of that they take for the true square of the piece, which is altogether false, (as I said before) though Custom doth strongly uphold that error against Reason. But if it be a true squared piece of Timber, then you may measure it this way, very Readily; as,

Example 9. A piece of Timber 10 Inches square, and 16 foot long.

The Rule is this: Always set one poynť of your Compasses on 12, extend the other to the side of the square in Inches or parts, that Extent will reach from the Length in feet or parts, to a fourth Number, and from that Number to the Content in feet and parts; that is, it will

will reach from the Length of the piece of Timber in feet and parts, to the Content in feet and parts.

As thus, in this Example: Extend your Compasses from 12 to 10 (the side of the square in Inches) that distance will reach from 16 (the Length in feet) at two turns of your Compasses, to 11 foot, and a little above $\frac{1}{2}$, viz. 11 foot and $\frac{3}{4}$. Be sure alwayes to remember, that if your piece of Timber be less than 12 Inches square, then you must turn twice from the Length of the piece, to the Left hand; but if more than 12 Inches, then to the Right hand twice.

Now this being the way in use, I will shew one Example more: of a Tree 30 foot long, having the Circumference 60 Inches; now the fourth part of 60 is 15, which I take for the side of a square equal to that Circle, as is usually done, though not with truth alwayes.

Example 10. Then I extend my Compasses from 12 to 15 (the side of the Square in Inches) and that Extent will reach from 30 (the Length in feet) to near 47 feet. the Content; this is the customary way, but if you look into the Table, *pag. 174*, you may there see, that 60 Inches Circumference, one foot length gives 1.988, which multiplied by 30, gives 59 foot and 640; here also you see the error of the customary way; but of this I have said enough already, and therefore shall give no more Examples now; but note this, that what is here said of Foot-measure, may also be applied to Pole, Yard, or the like.

Having the Root given, by two turns of your Compasses, you may save two Multiplications, and find the square of that Root, and the Cube, &c. and so may you find as many Numbers as you please, in a continual Proportion.

Example 11. The Root being given, extend your Compasses from one to 12, that Extent will reach from 12 to 144, the same Extent will reach from 144 to 1728; so then, if 12 be the Root, 144 is the square of that Root, and 1728 the Cube of that Root, &c. but note, that when you extend your Compasses from 1 to 12, the next turn will go off the Line; therefore you must seek 12 at the beginning of the Line, to the left hand, and then turn from that 12; note this in all Cases wherein your Compasses go off the Line.

Thus having shewed you (the Root being given) readily to find the Cube, I will now shew you (the Cube being given) how to find the Root; and though this, and some other Examples before, be not done by Multiplication, yet because they depend one upon another, I do here shew them.

To extract the Cube-Root, the Rule is; divide the space between the

the Cube given, and 1, into 3 equal parts, and the distance of one of these 3 parts from 1, is the Root.

Example. 11. The Cube 64 being given, what is the Root? divide the Distance from 64. to one into 3 equal parts, one third part of that distance will reach from one to 4, the Root; for the first third part will reach from 64 to 16 the square, the 2d third part from 16 to 4 the Root, the third part from 4 to one, for 4 times 4 is 16, and 4 times 16 is 64; the same Rule observe for any other number.

Thus may you find the square of any Circle, or the end of a tree, the square equal to that Circumference, and so measure it as is before shew'd.

Example 12. Having the Circumference of a Tree, you would know the side of a Square equal to that Circumference, as, in the 10th. Example the Circumference was 60 Inches, now to find the Content in superficial Inches of such a Circle, the Rule is as is before shew'd, as 22 is to 7, so is the Circumference to the Diameter; now if you Extend your Compasses from 22 to 7, that Extent will reach from 60 to 19. and $\frac{1}{2}$, the Diameter, this Fraction may be turned into a Decimal Fraction, and so wrought, but being so small it is not worth minding in such operations as this: then if you take half the Diameter and $\frac{1}{2}$ the Circumference, and multiply one by the other, or if you Extend your Compasses from one to 9 and $\frac{1}{2}$, that Extent will reach from 30 to 285 the superficial content in Inches, then to find the square by the Line of Numbers, that is, to finde a Number which if Multiply'd in its self, makes this Summe; the Rule is, Extend your Compasses from 285 to one, and the middle between these 2 Numbers is $16 \frac{881}{1000}$ very near, as here you may see: but first note, that if your Rule have but the Lines on it that most of your ordinary Rules have, that is, but 2 Lines on it as 1.2.3.4.5.6.7.8.9; and 1.2.3.4.5.6.7.8.9.10; then this Question may be some trouble to work on such a Rule; but if your Rule hath 4 parts or 6 parts, as a 6 foot Rule may have, then this Question may be performed very readily, as you may hereafter better perceive; for if you take 285 in the second part of the Rule, then is the middle figure one, a 100; and the figure one at the end is 10; and the Rule is, that you must take the middle between 1 and 285, which here you cannot; for if you count the first one, one. the middle one is then 10. and the end one is 100, so then 285 is off from the Line; whereas if your Rule had another part added to it, then might you work, and read it very readily.

But to work it by this Rule, you must take the distance from 100 to 285, that is from the middle one to 285, then take half of this distance and

and add it to half the length of the Line, and the Compasses will reach from 10 in the middle to near 17 (the side of a square equal to 285) as you may see it here proved by the pen.

Here you may see that $16 \frac{882}{1000}$ Multiplied by $16 \frac{882}{1000}$, gives 285 : and $\frac{0.001514}{1000000}$, which Fraction being so small is not considerable.

Many other wayes there be to measure a Cylinder, but this, after you have found the side of a square equal to the Circumference, Multiplied by the length is sufficient, &c.

$$\begin{array}{r}
 16.882 \\
 16.882 \\
 \hline
 33764 \\
 135056 \\
 135056 \\
 101292 \\
 16882 \\
 \hline
 285.001924
 \end{array}$$

CHAP. LI.

Division on the Line.

THe Rule is, as one is to the Divisor, so is the Dividend to the Quotient ; or as the Divisor is to the dividend, so is to 1 to the Quotient.

Example.

280 being to be divided by 5, set one foot of the Compasses on 5, and Extend the other to one, that Extent will reach from 280 to 56, the Quotient.

Or thus, Extend the Compasses from 5 to 280, that distance will reach from 1 to 56, the Quotient.

Example. 2.

260 divided by 5 $\frac{2}{5}$; Extend the Compasses from 5 $\frac{2}{5}$ to 260, that Extent will reach from 1 to 50 the Quotient.

By these Rules may you work any other Question in Division, for Division is easier than Multiplication, for in this (having the Sums given) you look for less, and in Multiplication the Sums being given, you may seek for greater.

CHAP. LII.

The Rule of Three on the Line.

THIS Rule, which by most is called the Golden Rule for its Excellent uses, is performed with much ease; only by 2 turns of your Compasses, and in working differs little from Division.

The Rules are, if 4 Numbers are proportional, their order may be so transposed that each of those terms may be the last in proportion, in this manner.

1. As the first is to the second, so is the third to the fourth.
2. As the third is to the fourth, so is the first to the second.
3. As the second is to the first, so is the fourth to the third.
4. As the fourth is to the third, so is the second to the first. See Mr. *Oughtred's* Circles of proportion pag. 77.

So that four proportional Numbers being desired to be known, if any three be given you may find the fourth.

As if 2, 8, 6, and 24. be the Numbers given, these Numbers may be so varied (as is aforesaid) that if any three be given, you may find the fourth; Note,

First, If 2 costs, gives, or requires 8, then 6 costs, gives, &c. 24.

Secondly, If 6 gives 24, then 2 will give 8.

Thirdly, If 8 require 2, then 24 will require 6.

Fourthly, As 24 is to 6, so is 8 to 2.

Fifthly, Or thus it may be, as 2 to 6, so is 8 to 24.

Here are five ways that will teach you, if you have three Numbers given, to find out the fourth proportionable to them, but the first and last are most useful, and are many times good proofs one of the other.

Example.

If 2 of any thing cost 8 *sh.* then 6 will cost 24 *s.* for if you Extend your Compasses from 2 to 8, that same distance will reach from 6 to 24, the Question; or if you Extend your Compasses from the first Number to the third Number, that same Extent will reach from the second number to the fourth, which was the thing sought.

Extend your Compasses from 2 to 6, that same Extent will reach from 8 to 24, the Question as before, &c.

Example.

Example. 2.

If you sell your timber by the Load, that is, 50 foot to the Load at any price to know what it is a foot; as if you sell for 25 shillings the Load, what is that a foot? First, know how many pence is in 25 shillings, because your foot will cost pence and not a shilling; 25 shillings is 300 pence, then the Rule orders it self thus, as 50 to 300, so is one to 6; therefore Extend your Compasses from 50 to 300, that distance will reach from 1 to 6; so then one foot costs 6 pence, the Question.

If you would know the price of 2 Foot, then set one poynt of your Compasses on 2, the other will reach to 12, and so many Pence two Foot will cost; and so of any other summe.

Example 3.

If a Load of Timber, or 50 foot of Timber, &c. be sold for 37 *s.* 6 *d.* that is, 450 pence, what is that for one Foot? Set one poynt of your Compasses on 50, extend the other to 450, that same Extent will reach from 1 to 9, and so many pence will one Foot cost, at 37 *s.* 6 *d.* the Load. And if you would know what 6 Foot will cost, the same distance of your Compasses will reach from 6 to 54, and so many pence 6 foot will cost, at the aforefaid price.

But now having the price of one Foot given you, and you would know what that is a Load; as if a Foot cost 9 *d.* the Rule is thus: Extend your Compasses from 1 to 9, that Extent will reach from 50 (which is a Load) to 450, the Pence that a Load costs; and if you would know what this is in Shillings, extend your Compasses from 12 to one, being 12 *d.* makes one Shilling, that Extent will reach from 450 to 37 and a half, that is, 37 Shillings and 6 pence, for 1 a Shilling is 6 *d.*

Example 4.

By this Line and Compasses you may soon find the Decimal Fraction of any summe, the Integer being but given: If it be required to know the Decimal Fraction of 15 *s.* the Pound or 20 Shillings may be 10000 or 1000 or more; for the larger you make this summe, the better will the Fraction appear. But because great summes cannot be so well wrought on the Line, I will take the Integer or 20 Shillings to be put into 100 parts; and then if you extend your Compasses from 20 to 100, that Extent will reach from 15 to 75, the Decimal of 15.

Thus if you would know the Decimal Fraction of thirteen Shillings, if you keep the Extent of your Compasses fixed, which you took from 20 to 100, that Extent will reach from 13 to 65; So then 65 is

the Decimal of thirteen Shillings. If you would know the Decimal of 5 Shillings, the same Extent will reach from 5 to 25, the Decimal of 5 Shillings. The Decimal of 2 Shillings is 10, the Decimal of one Shilling is 05, that is 5 of 100; for if that Cypher were not prefixed before it, then were it but 5 of 10. Thus by these Rules may you know any other Decimal Fraction.

Example 5.

If 100 *l.* gain 120 Shillings in one Year, or 6 *l.* what will 30 *l.* gain in the same time?

Extend the Compasses from 100 to 120, that same will reach from 30 to 36, so that 30 *l.* will gain 36 shillings in one year, twelve months or 365 dayes.

Example 6.

If one year, or 365 dayes yield for the Interest of 20 pounds, 24 *s.* or 288 pence, what will 60 dayes yield for 20 *l.*?

Extend your Compasses from 365, the dayes in one Year, to 288, the Pence in 24 Shillings, that same Extent will reach from 60 to 47, and neer a $\frac{1}{2}$, so that 20 will yield in 60 dayes 47 Pence $\frac{1}{2}$ and better.

These few Rules of many will shew you the manner how to work the *Golden Rule* direct on the Line of Numbers: There is also the *Golden Rule reverse*, or *backward Rule of Three*, and though it is not so usefull as the direct Rule, yet it is worthy to be known, for its excellent uses: The *Rule of Three direct* you see, the Number that is sought, ought to proceed from the second term, as the third did from the first in the same proportion: Therefore if you multiply the Second Number by the third Number, or the third by the second, their Product divided by the first, giveth the fourth.

CHAP. LIII.

The Golden Rule Reverse by the Line of Numbers.

THE Rule of *Three Inverse* is when the Number sought proceeds from the second term in the same proportion as the first, proceeds from the third.

And if the third Number be greater than the first, then will the fourth Number be less than the second: But if the third be less than the first, then the fourth will be greater than the second.

In this Rule if you multiply the first term by the second, and divide the Product by the third, the Quotient sheweth the fourth.

The first Number and the third must be of one Kind, and the second Number or middle Number of the three given, must be of the same kind with the fourth.

Example 1.

If 24 Men do any piece of work in 16 dayes, how many men are required to do such another piece of work in four dayes. According to the Rules before named, though 24 be here propounded first, yet it must be in the Second place, and then the Question will order it self thus:

As 4 is to 24, so is 16 to 96:

Or thus, As 4 is to 16, so is 24 to 96.

Therefore, extend your Compasses from 4 to 24, that same Extent will reach from 16 to 96.

Or the Extent of 4 to 16 will reach from to 24 to 96,

So that if 24 do a piece of work in 16 dayes, 96 will do as much in 4 dayes.

Example 2.

If 9 Bushels of Provender serve 8 Horses 12 dayes, how many dayes will that serve 16 Horses?

The Question will order it self thus: As 16 is to 8, so is 12 to 6.

Or as 16 is to 12, so is 8 to 6.

Extend your Compasses from 16 to 12, that Extent will reach from 8 to 6: So that if 9 serve 8 Horses 12 dayes, it will serve 16 but 6 dayes.

If this Question had been in the *Rule of Three direct*, then it would have ordered it self thus: If 8 had cost 12, then 16 would have cost 24.

But in this Inverse Rule, you must begin with 16, which is the third Number, and so work backward, as is before shewed at large.

Example 3.

If such a Quantity of Bisket will serve 100 men eight weeks, how many men will it serve ten weeks?

In this Example, as in the other, you must begin with the third summe first, and so work back, as before; for here the third summe is 10, which you must begin withall, and the Question will order it self thus.

As 10 is to 8, so is 100 to 80; therefore to work it by the Line, extend your Compasses from 10 to 8, that same Extent will reach from 100 to 80: So it will serve 80 men 10 weeks.

There be many other Rules which may be wrought on the Line of Numbers: But if you would be further satisfied, see the works of Mr. Gunter, Mr. Wingat, &c. And I shall conclude with Holy David, Psal. 115. last Verse, as I hope you will with me; *But we will praise the Lord, from henceforth and for ever. Praise ye the Lord.*

CHAP. LIV.

Of Levelling any Ground, and to make Slopes or Batteries, &c.

TO level any piece of Ground that you can see from side to side, or from the Middle to any side, goe into the middle, and there set up your Instrument, be it Water-level, or Ground-level with sights, and when you have placed it so high as you may see over the highest part of the Ground, as half a foot, or a foot, then set a stake in the middle, the top exactly level with the sights; and one on the highest side, the top level with the middle stake; then turn the Level or Lood back sight, and set one Level with these two on the lowest ground: So have you three stakes in a Line level: Keep your Level true to your Middle-stake, and turn your Level till it makes Right-angles with these three stakes, and set up two stakes at each side one Level with those three: So have you five stakes set true Level in two Lines; and if your Ground be large, you may set up two Rows more by the Level. but in small Grounds 5 stakes is enow: Then may you lay by your Level, and looking over the head of one to the head of another, cause your Assistant to put down stakes between two and two, till you have set as many stakes level in your Ground as you think convenient: Or you may have a Rule, and look over the edge of that, it being level with the head of the stake, to the head of the other, and put stakes down between you and the other stake, what Number you please.

Thus having staked out your Ground with all the stakes heads level, and half a foot higher than the highest part of your Ground; in some
Ground

Ground the middle-stake and the stakes in the Cross-line will be the Level-line the Ground must be brought to ; that is, abating the hill, and filling up the low side to the Level of the Mid-line ; but if your Ground be very uneven, then you must measure over all the stakes, and take them middle-high, for their mean Level, and by the Rule of Three proportion your Ground to that.

Suppose a Valley be 10 Pole long, and two foot deep from the straight Line, and there is a hill 5 Pole long, how many foot deep must I goe in that 5 Pole of the Hill, to fill up this Valley ? This may be answered by the Rule of Three Inverse, or back Rule of Three : The Rule orders it self thus. As 5 is to 2, so is 10 to 4 : So if you work it by the Line of Numbers, extend your Compasses from 5 to 2, that same Extent will reach from 10 to 4, so then you must goe 4 foot deep in such a Hill, to make good such a Valley as is before said.

Suppose you are to abutt the top of a Hill four foot deep and 1. 2 Pole from the top of that Hill, that 4 foot is to come out : this is easily performed, (though a Leveller to the best man in the Land did not understand it) set up a stake on the top of the Hill two foot or three foot long, above ground, and another at the same height where your depth comes out ; three Rod from that set a stake down, till the head comes to be in a Line with these 2, and at that stake you must be one foot deep : At 6 Pole another as before, there you must be two foot deep ; another at 9 Pole, there you must sink three foot. You may set more stakes at equal distances, which will direct you that you cannot goe amiss.

To make any Sloop, first line out your top and foot true, then if your Sloop be not very long, you may have a Frame of Wood made according to your Sloop, which will be as a Mould to trye your work by. Two foot Rise, in 6 foot Level is a good Proportion for a Sloop.

CHAP. LV.

For making Syder observe these Rules.

WHatsoever Apples you make your Syder of, let them hang on the Trees untill they be through Ripe, which you may know by these few infallible Rules: First, if you find the Kernels Brown, or the Seed rattle in the Apple, as in some they will, or if you see them begin to fall much in still weather; or if you find them to handle like a drye piece of wood, sounding in your hand if you tosse them up; then you may go to gathering as fast as you please, so your Fruit be drye; observe that the greener your Fruit is, the fouler will your Syder be; therefore be not too forward in gathering.

For gathering your Apples, observe these Directions: Take care they be not too much bruised; for your bruised Fruit, if they be a little kept, will rott, and give your Syder an ill taste, and a high brown Colour, and not yield so well; for your bruised place of the Apple, if it doth not immediately rott, the Juice of that place will vapour forth, and be a dry Red, yielding little Taste or Liqueur, but sometimes a bad taste.

But to the making of one Hoghead of Syder, there is required a great many Apples; as if they be good yielding Fruit, and not too long kept, some 18 or 20 Bushel will make a Hoghead; if not, as aforesaid, then 24 Bushels, or more, to one Hoghead: Therefore, though I would not have your Apple too much Bruised, yet I would not advise you to pick them by hand: But you may lay a Truss or two of Barly Straw under your Tree when you goe to gather them, and on that lay some Blankets (or the like) according to the Bigness of your Trees; thereon with Discretion shake your Fruit, letting not too many lie on at one time, but carry them to the Place where you intend they shall lie till you grind or beat them: Thus you may remove your Straw and Blankets from Tree to Tree, as your pleasure is.

Now

now for keeping them after you have gathered them, let it be in some house if you can with convenience, and on some dry boards or boarded floors, but if it be an Earth-flower you must lay them on, first cover it with good dry straw, and so lay them on that, for if you lay them on the earth they will decay faster, and turn musty before they have done sweating; for 'tis observed that which is best to preserve Plants is the quite contrary to keep and preserve Fruit, for the holy Scripture telleth plain, that which a man soweth must first dye, before it take root to live and produce its kind.

Thus it may be with fruit lying on the ground, where the secret vapours of the earth tend much to the death or dissolution of the fleshy part of the fruit, that the seed might the sooner be at liberty, to produce its like in its several kinds; for Nature, or the secret providing power of the Almighty, is at all times, and in all places actuating and assisting every species to produce its kind; for any who hath but observed the Walnut or Chestnut, though one hath got his Fur Gown & the other his Noli-me tangere Cloke, as to too of the senses, yet notwithstanding, when they be able to shift for themselves, (as I may say) then how willingly the Gown and Cloke is thrown aside, to venture boldly to the Earth, for to do as at first their parents did for them, but of this see further in the Chapters before; and since we are now speaking of one particular fruit, viz. Apples, of the time of their keeping before you make them into Syder: a set time I cannot deliver, for your Summer Fruit will be ready to beat before your Winter Fruit: but as soon as you have seen them sweat, which will be in ten dayes, or a fortnight, then to beating or grinding of them as fast as may be, keeping your Fruit several, if you have enough to fill a vessel of one kind, if not, put such kinds together as be near ripe together, the Syder will ferment more naturally.

But let your winter fruit lye three weeks or a month before you beat or grind them: the greener your fruit is when gathered, let them lye the longer before you beat them: Thus when you have beaten or grinded your Apples: let them lye a night or 24 hours if you please before you press them, it will make your Syder have more of the Sack-Colour, and hinder it from Fermenting too much; and if your fruit be ripe to eat, or mellow, then put to every twenty Bushels of stampings some six gallons of clear water, put that on the top of the stampings as soon as you have beaten them; if your fruit be soft and mellow you may put more, if not, the less: this also will keep your Syder from fermenting too much, and though your Syder be weaker it will be much pleasanter: Therefore if your Apples be mellow before you

beat them, there will go so much of the fleshy substance of the Apple through the strainer or bag, with the Liquor that it will be hard to get this Lee separated from the Syder, before it begins to ferment, for the Liquor will endeavour to free it self of these little particles which when once separated from the united body, turneth to an earthy substance, and then the Liquor working hard to free it self of these then useles and decaying parts, and having no place to turn them out at, but at the bung, and it being contrary for these earthy parts to ascend upwards, causeth by its much fermenting, not only the strong, but also the pleasant Spirits to take their flight, and go into the great world to be ready to assist at another new generation, and so leave the Liquor both dead and of a soure taste, which when these higher Spirits are fled, then soureness doth master the taste in the Syder, which it receives from the gross Lees in the vessel; therefore if your Syder be made of mellow fruit, let it settle 24 hours in som Fatt or large vessel, that the gross Lees may settle to the bottom before you put it into your vessel, and then draw it off, leaving as much of this thick gross Lee behind as you can (which gross Lee you may put among your pressings for water-Syder) and if you think the Syder is yet so thick that it will work much, then draw it into another tub by a tap two or three inches from the bottom; and in this last tub let it settle so long as you think it is neer ready to work in your tub: for if it work in your tubbs then will you get but little of the gross Lees from it: you must keep it covered all the time it is in your tubs; for note the finer you put it up into your Vessel the less it will work or ferment, and the less it fermenteth the better will your Syder be; but if you should have childe the Syder, as sometimes it may so happen in cold weather, that it doth not work at all, when you have put it into your barrel, or hoghead, but is thick, in such a case put to a hoghead a pint of the juice of Alehoof, with half the quantity of flinglass, and it will make it clear and fine; but if it do it not presently, do not despair, for it will ferment possibly in the spring or when the fruit blossoms that it was made on, the Spring after it was made.

Having observed these few Rules, then put it into your barrel or hoghead, and as soon as it hath done working, bung it up, there keep it till it is fit to bottle, which let it be when it is fine; for if you bottle it while it is thick, or not well settled, it will endanger your bottles, and not be so wholesom: but some do love to have their Syder cutting, counting it then the better; this may be performed if your Syder be fine, by putting a little bit of Loaf-Sugar, in every bottle, when you bottle it, and thus more wholesom.

I am of the same opinion with *Sr Paul Neal*, that the finer Syder
by

by any accidental cause doth ferment, the worfe it is; if twice it will be harder or fower than if it had fermented but once: and if it ferment thrice it is still worfe; therefore keep it if you can from fermenting or working too much, and also too often.

As for the sorts of Fruit the Redstrakes and Gennet Moyle, are the best counted; yet there be many sorts of fruit which if the Syder be well ordered will be little inferior if not better: The Golden Pippin makes excellent Syder; the Kerton Pippin, the Russet Harvy, Kentish Codlin, &c. makes good, or indeed any Apple that is not a Crab; for there be many sorts of Wildings that have a fine Winy Liquor, and the flesh of a hard, and not of a soft substance; for that Fruit; (let it be Pear or Apple) that hath the flesh soft, and is soon Mellow is not good for Perry or Syder; for such very soft Fruit doth break into so many small particles, that they spoil your Syder before they can be separated, but that Fruit that hath its flesh hard, that when you beat and press it, will flat down like a sponge, sooner then it will separate into little particles; and if it be kept beyond its natural time of being ripe, will grow tough but not Mellow, is the only Fruit for Syder and Perry, for by Sir Pauls leave it is not alwayes the best eating Apple or Pear that makes the best Syder or Perry, but such as aforesaid, no more than the best eating Pear is the best baked; and of this dayly experience sheweth the contrary.

Much more I could say concerning Syder, but if there were a whole Volume writ of it, yet the several seasons of years, the several sorts of Fruit and other accidents that happen, no man can advise you of before, therefore let your reason teach you with what hath been said before; but if you would see several mens opinions of the ordering of Syder, see Esquire *Evelins* Book, joyned to his Discourse of Forest-Trees.

To make your water Syder; take the stampings when you press them from your first Syder, and put them into tubs, and when you have a tub full, put to these stampings half as much water as you had Syder: if your Fruit be good and very ripe you may put more, if the contrary less; let the tubs be covered, and stand thus with the water and stampings together four or five dayes and nights: if it be cold weather let them stand a week, then you may press the stampings, and as soon as you have got as much as you think will fill a vessel, put it on the fire and scum it well, and when you find the scum begins not to rise very fast, then take it off from the fire and put it into Tubs or Coolers, to cool, and when it is cold then Tun it up, and when it hath done working then bung it up, and in a months time it will be fit to drink; you may if you please boyl a little Ginger in it, or a little Cloves, Juniper berries, or other things which you fancy to please the pallet, or against

some distempers you fear; for small things taken in time may prevent dangers very great; Syrupe of Rasburies gives a very pleasing taste in Syder.

Perry may be made and ordered after the same manner, only take care your Pears be not too ripe, for if they be, you will be troubled to get your Liquor fine: those Pears be best for Perry that have a hard flesh, and stony at the core; the juice easily separating from the flesh, the Fruit yielding a good plenty of juice, the Pears commonly of a harsh taste.

But those Pears that have a soft flesh, as many of our best eating Pears have, are not good for Perry; as the Burry, Borgatmotes, Green-seilds, Green-chefels, and several others of like nature.

We have a Pear at *Cashibury*, and it is at other places near *Watford*; it is a little harsh juicy Pear, but makes excellent Liquor, as my Honourable Lord can testifie, and several others; its only inconvenience is, it is but a small Fruit, but the quantity it yields is good; I take it to be a kind of wild Pear never grafted; but for its excellency aforesaid, the kind deserves to be preserved by the curious, I know no name it hath as yet.

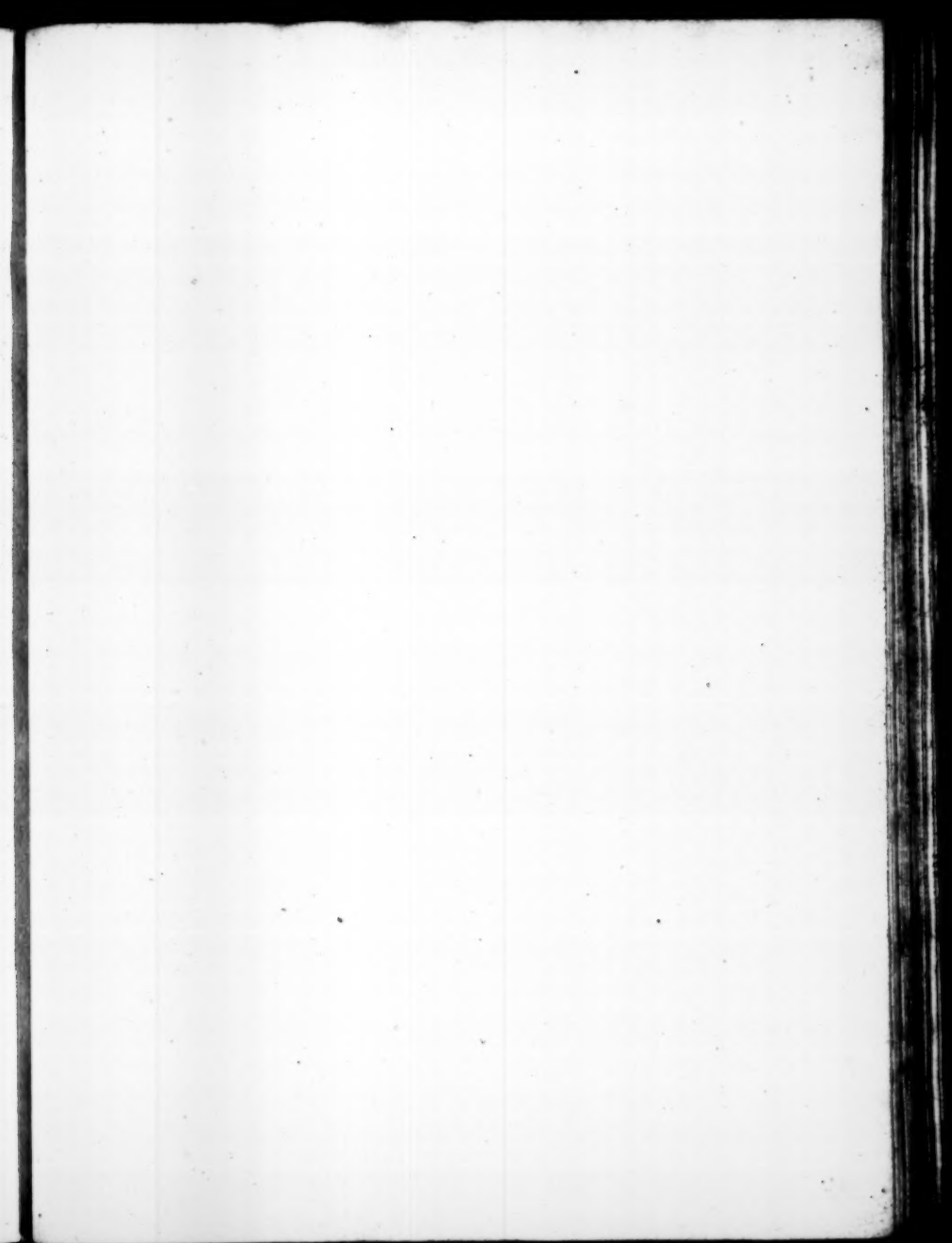
Captain *Wingate* near *Welling* hath an excellent Pear for Perry; I have tasted of the Liquor, and have seen the fruit, but whether it is a good bearer or no I know not: which should be a property in Perry Pear-trees.

There is a Pear called by my ingenious Friend Mr. *Pritchett* Gardner to my Lord of *Salisbury*, Rufins Pear, which makes excellent Perry, and is a good bearer, as I have oft been informed by him; by the taste of the fruit it is very good for Perry: Indeed most sorts of baking Pears make good Perry, or any that is Qualified as is before said, and that bears well, and yields great store of Liquor.

Mind your Vessels be sweet you put your Syder or Perry in; for a little tang in the Vessel will spoil all, a Sack Vessel is very good (though discommended by some) so is your White-wine or Clarret-wine cask, or a Vessel where Syder hath been before, &c.

F I N I S.

Here place the Figures.



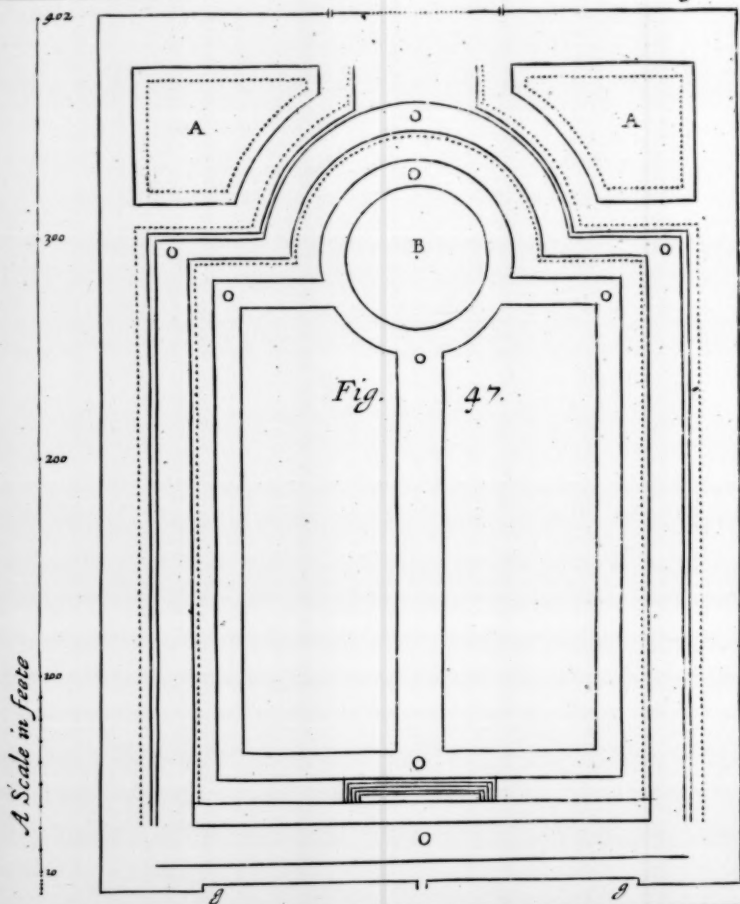
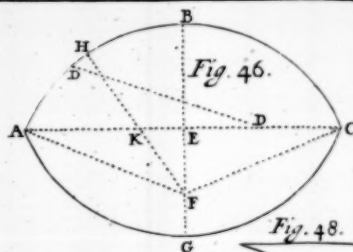
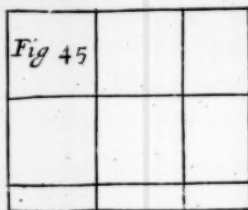
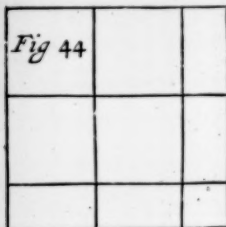


Fig. 26.



Fig. 27.

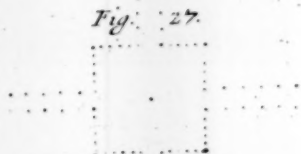


Fig. 28.

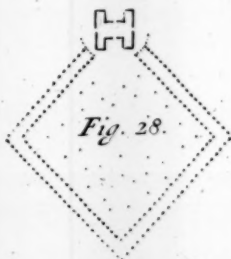


Fig 29

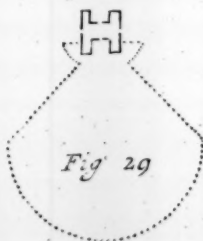


Fig 50.

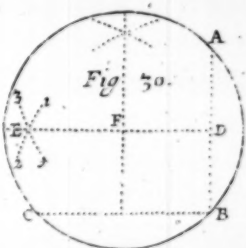


Fig. 33.

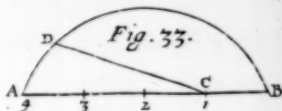


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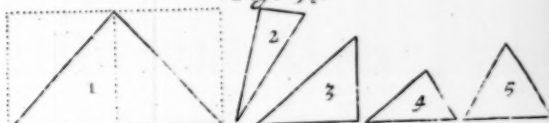


Fig 32

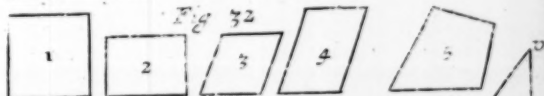


Fig. 35.

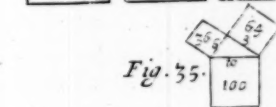


Fig. 34

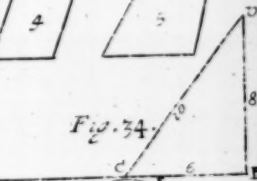


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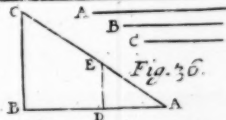


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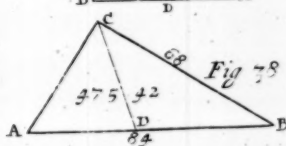


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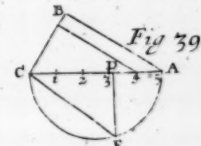


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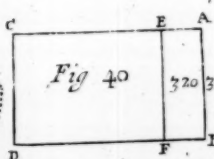


Fig 4

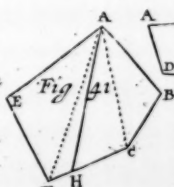


Fig 42

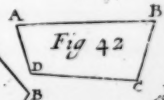
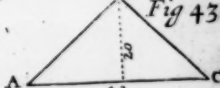
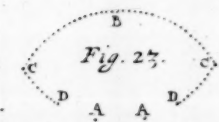
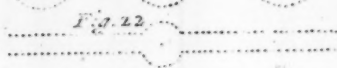
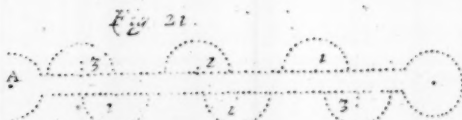
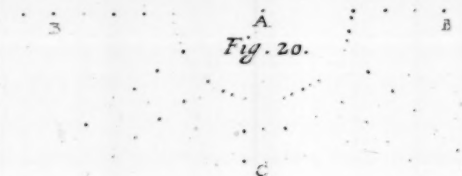
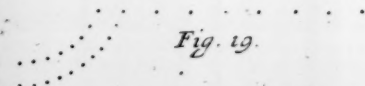
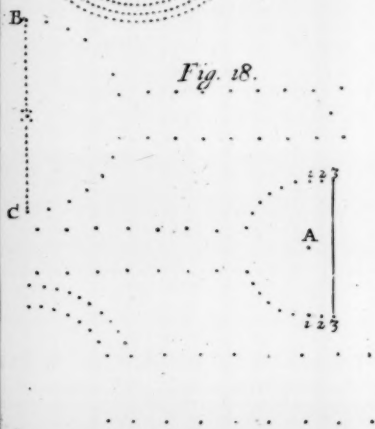
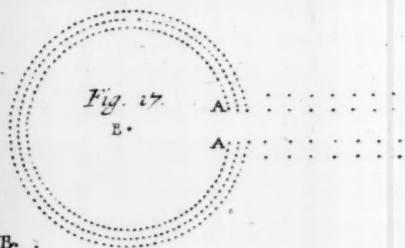
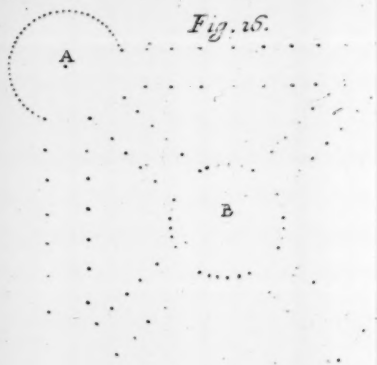
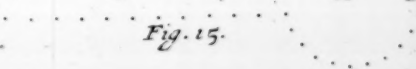
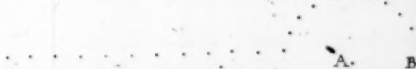
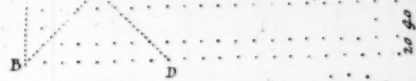
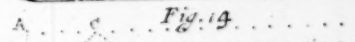
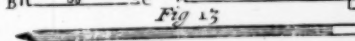
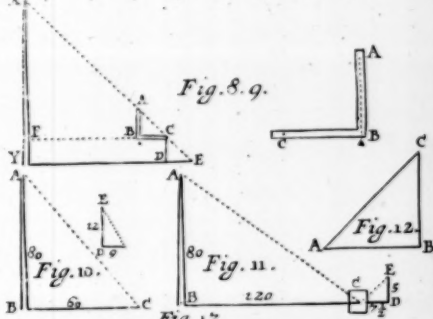
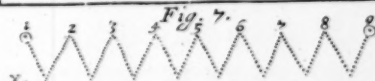
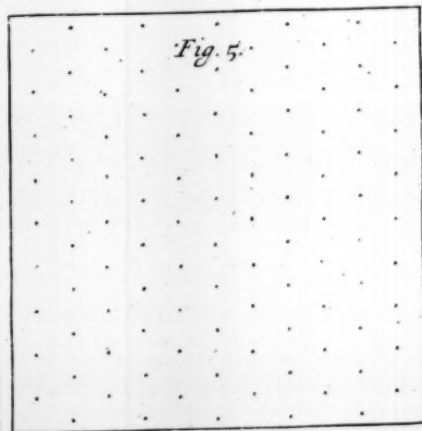
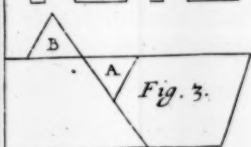
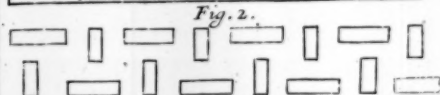
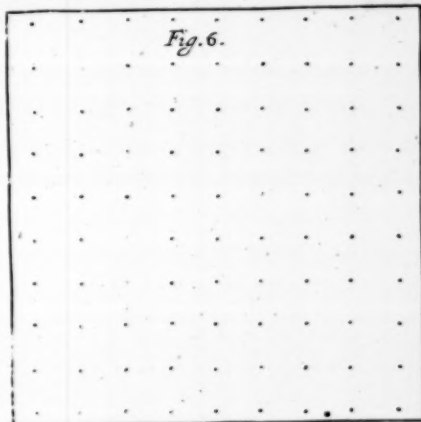
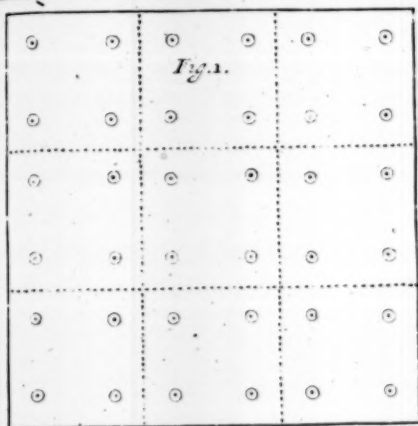
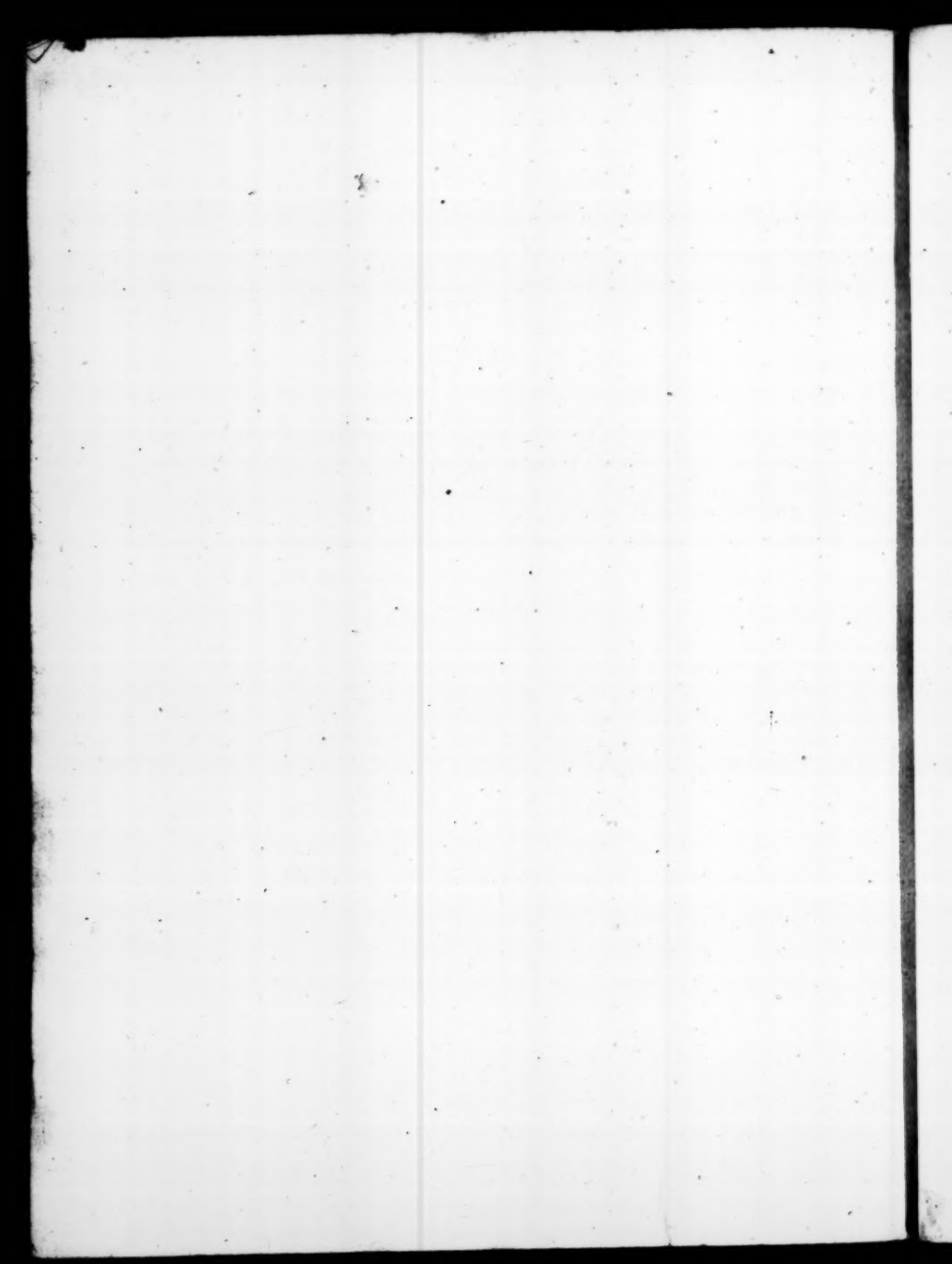


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*A Catalogue of Books of Husbandry, Sold by Peter Parker
at the Leg and Star in Cornhil.*

THe *English Gardener*, or a sure guide to young Planters and Gardeners, in three Parts. 1. Shewing the way and order of Planting and Raising all sorts of stocks, Fruit-trees and shrubs, with the divers wayes and manners of Ingrafting and Inoculating in their severall seasons. 2. How to order the Kitchen Garden, for all sorts of Herbs, Roots and Sallads. 3. The ordering the Garden of pleasure, how to Raise all sorts of flowers, and their seasons; with directions touching Arbors and Hedges in Gardens; likewise severall other things fit to be known to all that delight in Orchards and Gardens. By *Leonard Meager* above thirty years Practitioner in the Art of Gardening.

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A Discovery of
Subterranean Treasure :
(viz.)

Of all manner of *Mines* and *Minerals*,
from the *Gold* to the *Coal* ; with plain Directions and Rules
for the finding of them in all Kingdoms and Countries.

AND ALSO

The *Art* of Melting, Refining, and Assaying of them is plainly Declared, so that every ordinary man, that is indifferently capacious, may with small charge presently try the value of such *Oars* as shall be found either by Rule or by Accident.

Whereunto is added

A Real Experiment whereby every ignorant man may presently try whether any piece of *Gold* that shall come to his hands be True or Counterfeit, without defacing or altering the form thereof, and more certainly than any Goldsmith or Refiner could formerly Discern.

ALSO A

Perfect way to try what colour any Berry, Leaf, Flower, Stalk, Root, Fruit, Seed, Bark, or Wood will give : With a perfect way to make Colours that they shall not stain nor fade like ordinary Colours.

Very necessary for every one to know, whether he be Traveller by Land or Sea, or in what Country, Dominion, or Plantation soever he shall Inhabit.

By Mr. Gabriel Platter.

L O N D O N.

Printed for *Peter Parker* at the *Leg and Star* in *Cornhill*,
over against the *Royal Exchange*, 1679.



To the Reader.

WHereas divers Reasons have joyned together to move me to take in hand this Taske: I will declare some few of those that may give the best satisfaction to the Reader, in this manner following. First, when I considered the great number of Treasure and riches which lyeth hidden in the belly of the Earth, and doth no good at all: and also the great benefit which might accrew to divers Kingdomes and Countreies, by setting people on work; not only in the discovering of them, but also in the severall operations about the digging melting and refining of them: also when I considered that the most part of the Mines hitherto discovered have come by meer accident: I thought that I could not be better employed than to give Rules and directions for the same: for though it is not impossible, that if two men be sent to seek a thing that is lost, and one of them be budwinked, and the other have the use and benefit of his eyes, yet the person budwinked, may casually stumble upon it; nevertheless it is twenty to one that the other should have found it before him: so in this case, I dare hazard a Wager of twenty to one, that there will be more good Mines discovered within seven years after the divulging of these Rules and directions, than hath been in twenty seven years before: Also when I considered that many Minerals found out by accident, hath come to no good by reason of the distance of place from Refiners, and men of Judgment and experience: for that the finders thereof were loath to come so far, and spend so much money upon an uncertainty as the triall thereof would require: I thought I could not doe a better deed, than to shew the manner of such trialls in such plain manner that every man may try the same in his Ship, or Chimny Corner with little cost and labour.

And the truth of this I can witness by experience; for when I was a youth, and had no skill in these affairs; I happened upon a Mineral fair to see to, and could find no man nearer than an hundred miles which could inform me of the true value thereof: whereupon, rather then to be at such charges as the triall required, I suffered the same to be neglected.

And though that the rules and directions given in this Book be exquisite, and give strong signs of Mettals and Minerals; yet I would be loath that any man should be thereby animated to take in hand great Voyages, and consume

To the Reader.

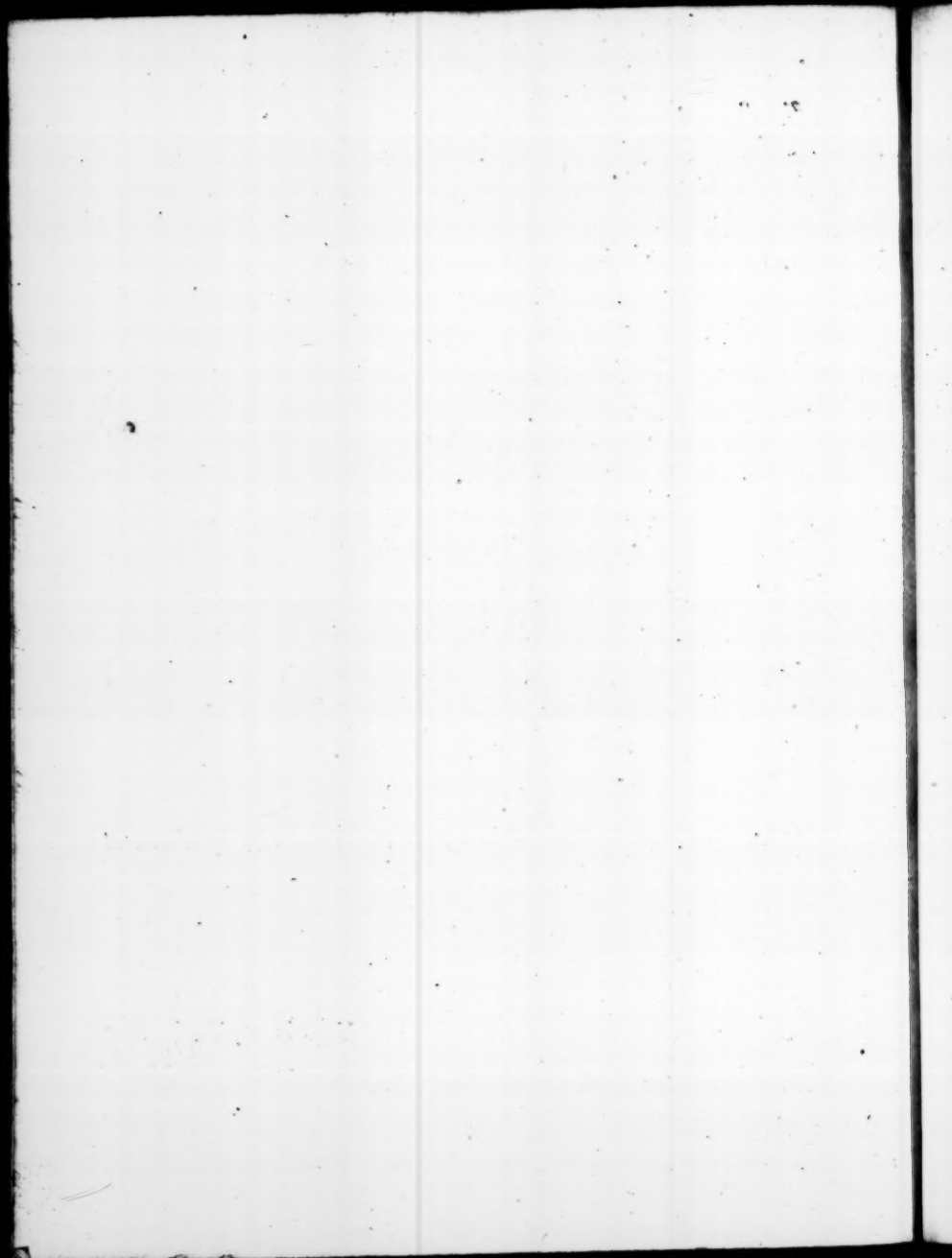
consume his Estate in the pursuit of this design; deeming them to be impossible ever to fail: but rather to make this a part of his business, when he shall come to such places as yield strong probabilities.

And so far I am from envying the former wayes in finding them by accident, that I have partly taken this pains; that those which shall hereafter be found by accident may not be neglected, as I conjecture, that many have been by my own formerly mentioned.

For I could wish that many men had the like fortune that one had, who in the climbing up of the great Mountain called Potersee, in the Kingdom of Perue in the West-Indies, took hold of a young Tree to stay himself withall; and thereby plucked it up by the roots, whereunto there did adhere good Silver Oar; which being tried and found rich, hath ever since been wrought upon: and innumerable treasure and riches have thereence been digged, to the valew of many hundred Millions of pounds Sterling.

And to the end I may no longer stay the Reader with Preambles, I will divide my Book into 12. Chapters, like as I did my Book Printed Anno. Dom. 2638. Entitled, A discovery of hidden Treasure: wishing all those that desire to be skilful in these affairs; to take a little pains to read that Book, which differeth from this no otherways, but as the Art of Surgery differeth from the Art of Physick: for as Surgeons deal chiefly with the external parts of mans body yet stand in need of the knowledge of all the parts; and as Physitians chiefly deal with the internal parts; yet cannot be without the knowledge of the external parts: So though that Book treats wholly upon the discovering of the Treasures hidden in the superficies and exurball parts of the Terrestrial Globe, yet the knowledge of many things therein contained are very conducive to make a skilfull Mineralist, giving you further to understand, that if any good will be done at all, it will be done with a small Charge: and with somewhat less than before this Book was published; if you observe the Contents thereof advisedly: So I take my leave and rest,

Your hearty Well-wisher
G. P.





A Discovery of all sorts of Mines and Minerals.

CHAPTER. I.

Wherein is shewed by a plain Demonstration the natural cause of the generation and production of Mountaines and Mettals: where-by the Seekers may obtain a good competent measure of knowledg to guide them where to seek for the other External signes.

SOLOMON saith, that Hope deferred breaks the heart; but the desire obtained, is a Tree of Life: If Hope onely deferred break the Heart; then Hope frustrated must needs break it a great deal more.

To the end therefore that our Hope may not be too frequently frustrated, I will first declare the places where there is no probability to find out Mettals, and afterwards I will shew where there is strong probability: and then in the next Chapter I will shew how to go about the work, to find out the strong signs which may rightly guide the Seekers to obtain their desire.

And first, there is no probability that any Mettals can be generated near unto the North and South Poles of the Globe, for those can by no means have any convenient Matrix for such a generation, being by all probabilities nothing but two Islands of Ice, for if they were any thing else, the course of Nature must needs alter, and change, and run presently out of order.

For as there is in the burning Zones a continuall exhalation of Water, and rarifying of the same into Air: so there must needs be in the North and South a continual condensation of Air into Water to supply the same again, else the motion cannot be perpetually circular.

Now whereas the North and South parts, by reason of their coldness, cannot suffer the said condensed Meteors to descend in form of Water, but in the form of Snow, Hail, or some substance of like nature, which there cannot melt in the superficies for want of heat, it is very probable that the new Accretion this way produced, doth presse down still with its weight the said Ilands of Ice towards the Center, where the central heat melteth it off continually, by which means the spherical form of both Earth and Water are perpetually preserved.

And if any man be of a contrary opinion, I will not envy him; but as for my own part, I will sell my Interest and hope of Mettals in those places for a Farthing, although I had a device that the cold there could not prevent my seeking for them.

Also in Vallies and plain Champion Countries, there is no hope to prosper in this design, for the womb of such earth is not apt for such a generation, the Reasons whereof will presently follow.

Now that we have left us no other places to seek in but the rocky Mountains, I will spend the rest of this Chapter in demonstrating the natural cause of the generation of Rocks, Mountains, and Metals, and so proceed forward.

And first I will set down the Opinions of others with their Confutation, and lastly, the confirmation of mine own Opinion by irrefragable Demonstration.

Some have thought that the mighty Creator made the vast, deformed, and craggy Rocks and Mountains in the beginning, but this appeareth to be an Opinion, whereby great dishonour may reflect upon the Creator, who besides his Omnipotent power, doth continually make use of his admirable Wisdom, and exquisite Artifice in all his works, and made nothing deformed or unfit for the use for which it was created: Now the Earth being ordained to bear Fruits for the use of Men, and Rocks are not fit for that purpose, it plainly appeareth that they came not by accident.

Some others have thought that they came by accident, but yet that they were produced by accretion in length of time, even as Warts, Tumours; Wenns, and Excreescences are engendred in the superficies of mens bodies: and of this Opinion I my self was in my minority, till such time as by practical experience I found out a more probable opinion.

Now for a plain demonstration, let this Experiment following be tried, and I make no question, but that it will satisfie every one that hath an inquisitive disposition.

Let there be had a great retort of Glassey, and let the same be half filled

led with Brimstone, Sea-coal, and as many bituminous and Sulphurous subteranean substances as can be gotten : then fill the neck thereof half full with the most free earth from stones that can be found, but thrust it not in too hard, then let it be luted, and set in an open Furnace to distill with a temperate Fire, which may only kindle the said substances, and if you work exquisitely, you shall find the said Earth petrefied, and turned into a Stone : you shall also find cracks and chinkes in it, filled with the most tenacious, clammy, and viscous parts of the said vapours, which ascended from the subteraneall combustible substances.

Whereby it appeareth that the same thing is done by Nature, and that the Rocks and craggy Mountains are caused by the vapours of Bituminous and Sulphurous substances kindled in the bowells of the Earth, of which there be divers so well known, that they need not be here mentioned : Also it appeareth that the veines of Mettals are engendred in the crackes and crannies of the said Mountaines, out of the most clammy and glutenous part of the said vapours there adhering, where the cold gave them leave to be congealed and condensed.

Now concerning the Exaltation of the Mountains above the Vallies, it appeareth to come to passe by the water in former times, whose property is to wear away by its motion the most loose earth, and to leave the more firme ground, and rockie places highest, but whether this was done by *Noahs* Flood, or by the Sea in former Ages, is doubted. As for my opinion, I referre the Reader to my Book formerly mentioned, and if any man be in doubt of this, let him take the stone formerly made by Art, and place it so, that the motion of the water may work upon it, and you shall find it worn most in the loosest places, and least in the more firme compacted places ; thereby shewing the natural cause of Mountains and Vallies. Also if a River should be turned out of his course, and the bottom thereof accurately considered upon, how the water by his motion hath worn away the Earth most in the loosest Earth, and least in that which is more firm, it doth evidently demonstrate the natural cause of Hills and Vallies, and the unevenness of the Earth caused by the motion of the Sea in former Ages.

CHAP. 2.

Wherein is shewed the signes of Mines and Minerals, with the manner how to work to find the same.

WHen we come to the Rocky and Craggy Mountains, the first thing we are to observe, is the barrenness of them; For the more barren they are, the greater probability there is that they contain rich Mines and Minerals.

The Next work is to find out the Springs of Water issuing out of the said Mountains, and those being found, a quantity of the said water is to be boiled in a new clean Pipkin, to the consistency of thin Oyl, but not so thick as a Sirrup, and when it is almost cold, then to put into an Urinall, and to set it in the coldest place that can be found for 3 daies, then to play the Physitian, and to observe it exquisitely what residence it yieldeth: if nothing settle but a black earth or mudde, it is a sign of *Coales*: if some part thereof shoot into Ice, or a substance like Ice or Vitrioll, then to observe the colour thereof; if it be green or blewish, it is an evident sign of Copper; if whitish, then it may signifie any other Metall without exception.

The next work is to go to the bare Rocks, and there to find out the clifts, cracks, and cranies; this done, to goe to the top: or till you find some Grasse growing right upon the top of the said, Cranies, and then to observe diligently the kind of that Grasse, and how it differeth from other Grasse ordinarily growing in the same Mountain; not only in form, but also in colour, which colour sheweth the greatest difference in the heat of Summer, for the subterranean vapours issuing out of the Orifice of Mines; differ from those which issue out of the more solid places of the Mountains.

The next work is to see if there be any marcasites to be found in the superficies of the said Mountains: which though they are usually of divers colours, and seldom good for any thing, yet they are strong signes of Mineralls within, being themselves the spume and froth of the better Mettals, breathed forth, even as Drink breatheth up his Yest or Froth to the superficies.

And these if they be put in an ordinary fire, they will turn black, and yield a smell of *Brimstone*, *Arsnicke*, *Antimony*, or some other thing, commonly called or known by the name of a *middle Minerall*.

The next work is to trie the operation with the *Virgula divina*, as beneath is declared: and where it sheweth the strongest signs, as is likewise beneath taught: and also the place is most accompanied with the other
signs

signes formerly mentioned : thereby digging or boaring to try your fortunes.

The operation with the *Virgula divina* is thus to be performed : some observe a set day and hour with certain words and Ceremonies at the cutting up of the same, which I have found to be little to the purpose, thus I wrought about Mid-summer, in a calm morning : I cut up a rod of Hasell, all of the same Springs groweth, almost a yard long ; then I tyed it to my staff, in the middle, with a strong thred, so that it did hang even, like the Beam of a Ballance : thus I carryed it up and down, the Mountains where Lead growed, and before Noon it guided me to the Orifice of a Lead mine : which I tryed, having one with me with an hacket of Iron and a Spide ; and within two houres we found a vein of Lead Oare, within less than a foot of the Grasse : the signs that it sheweth is to bow down the root end towards the earth as though it would grow there, near unto the Orifice of a Mine, when you see it doe so, you must carry it round about the place, to see that it turneth in the string still to the place, on which side soever you stand.

The reason of this Attraction I conceived to be of Kin to the Load-stone, drawing Iron to it by a secret vertue, inbred by nature, and not by any conjuration, as some have fondly imagined.

And the Reason of this my opinion was, because that in divers of my practicall Experiments I have observed an Attraction betwixt several things, like that of the Load-stone and Iron ; and if it were to good purpose, I suppose that I could shew more experience of that kind than any man in *England*.

Now in the new plantations, as *New-England, Virginia, Bermudas* &c. where it is like that few or none have ever tryed, that had any skill in these affairs, it is very probable that the Orifice of divers Mines may be discerned with the eye in the clefts of the Rocks in many places, as some have been in *England* at the first, before that men grew a little skillfull, and these to be lost and neglected, were a shame to the Planters ; for these Mines if they prove rich, would yield more gain in one year, than their Tobacco, and such trifles would yield in their whole lives.

CHAP. III.

Now that we are come to the melting and refining of Mettals, I will begin first with the Oar of Lead, because that is one of the most common Mettals found in these Northern Countries.

THE first work therefore to be done, is to have a little grate of Iron about a foot broad, like such as are used in a Still to make the fire upon: this is to be placed in your Chimney-corner with loose Bricks, one thickness underneath, and empty in the middle, to give air to the fire; then lay more Bricks above four course high, round about, and if they be laid without Morter, the fire will burn the better: then fill it with Char-coales kindled, in the midst whereof set your melting Pot, with one pound of Lead ore, and four ounces of filings of Iron mingled together, and so blow to it strongly with a pair of good hand-bellows, till it be well melted down; then let the Pot be taken out with a pair of Tongs, and set to cool: when it is cold, break it, and knock off the brittle einder lying upon the top of the Mettal with an Hammer, till none be left but the malleable mettal, which you may assay and refine in this manner following: Take a little Test made as beneath, and place it in the middle of your Chimney; lay ashes about it, about six inches broad, and as high, or rather higher than your Test; lay Bricks about the ashes to hold them up one Brick thickness, and two Bricks broad, then lay about half a peck of Char-coales upon the Test kindled, and when they are almost consumed, and the Test red-hot, put them by a little in the midst over the Test, and lay over a peece of good Oak-wood about five inches square, and eighteen inches long; lay it so upon two Tyle-sheards, that it may lye about an inch and an half above the Test, then lay on more ordinary Billets and some Char-coales amongst: make the fire about so strong as to roast a Pig, then blow to it a little, till the fire burn clear, then put upon the Test two ounces of your Lead, and blow to it gently, and in three quarters of an hour, all the Lead will be consumed, and the Silver will lye in the middle of the Test like a little Bead or Pearl, then put aside the fire, and let all be cold.

Then you may weigh the Silver in a pair of Gold-scales, and so cast it up how much there is in a Tun of Lead: I have thus tryed many Oares, and have found them to differ in goodness of all sorts, from Forty shillings worth of silver in a Tun, to thirty five pounds worth of Silver in a Tun, and there is no Lead but it holded some Silver, yet it is not worth the refining, unless it yield eight or ten pound upon a Tun at the least.

The

The Test may thus be made: first, let a Smith make a Ring of Iron about four inches wide, and two inches deep, and a quarter of an inch thick, and as wide above as beneath, and without a bottom.

Then burn Mutton and Beef-bones in the Fire till they be white, then beat them small in Morter, and searce them fine like meal: then with a little beer or water temper a small part thereof like pappe, then put to so much more of the dry powder by little and little, as will make it so stiff that it will not be made into a ball, but remain clammish, betwixt power and paste: then with a Pestle stamp it gently into your ring till it be top full, being set upon an even board, then stamp it a little lower in the middle than at the edges, and smooth it with a slight stone or some round glass, so set it in the Chimney Corner to dry a day or two, and it is ready for your work.

If you put a quarter of an ounce of Sandivert, and as much Salt-Petre mingled together with your powder of Lead, and filings of Iron at your first melting, it will melt somewhat sooner, and with less blowing, besides that the Sinder will part cleaner from the malleable mettall.

And if you want Char-coales, you may burn Wood in an Oven, and when it is red, and hath done smoaking, you may set up the Oven-stone, and damp it.

Or you may do the like in an open Chimney, and damp it in an earthen Pot, or cover it with Ashes, or damp it in a hole in the ground, by covering it with a cover, or with Ashes.

Any of these Coals will serve to make your assayes and tryals: as for directions for great works here is nothing intended in this little Book: but onely to be sure whether the work will quit the cost; which if it will then provision for great works will easily be brought to pass.

And if you want pots, you may be at choise whether you will buy the the same at the Gold-smiths, or Potters in London, which sell *Flanders* melting pots, or make them your self by this direction following.

Take right *Flanders* Jugs, such as they usually put Bottle-Beer in, beat them to fine powder, and searce them fine as Meal: Take of this meal four pound, of the fine powder of Tobacco pipe Clay one pound, temper them together with the red faitish water that issueth out of an Horse Dung-hill, beat it strongly upon a broad board with a Rowling-pin, till it be stiff Paste, then fashion your pots upon a peece of wood, turned like a Top, onely let the sharp end of the Top be thicker and flatter than an ordinary Top; then set them to dry in your Chimney Corner a day or two; when you use them, set them in the fire at the first kindling: and so let the Fire steal upon them till they be red hot: then put in your Mettle and ingredients, and cover it with a Tile-sheard, or cover of Iron, and so melt it down.

CHAP. 4.

Wherein is shewed the Operations for times.

THis Mettall may be melted down like the Lead, only omitting the filings of Iron : but when it is melted it is not malleable, till it be compounded with certain proportions of other Mettals, which I will not declare, because it is a secret of weight belonging to the Pewterers Trade.

And as for refining of it, I am sure it cannot be done by any artifice ; for I suppose that I have tryed more experiments about it, than any 10 men in *England*, because that I saw the Refiners could not do it : therefore I took the more pains and industry to bring it to pass ; which If I could have affected, I doe verily believe it would have proved a rich Mettall : but the more I tryed the worse I sped, for at the last of all I melted Gold and Silver equall parts with the Tinne, thinking thereby to bring it down into the Lead, and to make it to drive faire, and refine kindly, but all was vain, for the Tinne paysoned and consumed some of my rich Mettalls.

Now whereas there is no hope of any Royall mettall ever to be gotten out of this Minerall : to supply the shortness of this Chapter, I will shew a way how every one that hath a mind to meddle with these affairs, may have good possibility to enrich themselves and their posterity ; and be out of danger to undo themselves, or to damnifie themselves in any manner of value that is considerable.

For my meaning is, in the taking in hand of this task, to doe good to all, and hurt to none : and that no man from henceforth shall need to be at a quarter of the charge, study, or labour, which I my self have undergone.

Therefore seeing that if the most ingenious and exquisite wayes be taken in the design that wit can attain unto : yet it is but an adventure ; for sometimes all the labour may be lost, though not often, if good heed be taken ; and sometimes Mines may be found, which will not quit the charges to be wrought upon.

Therefore as wise Merchants will not hazzard all in one Bottom, so let this never be any mans design totally : for now there is no such need but they may do all that can be done at such spare times, as any Gentleman, or man of quality, usually spendeth in Hawking, Hunting, Gameing, or other pleasures ; whereof he needs but set a part of that time for these purposes ; having the most part of his work done to his hands in this little Book.

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If the Refiners shall grudge at me, for disclosing some of their secrets of their Trade, I will answer them in this manner : First, I my self have spent the time of divers Apprentiships in these affairs, and therefore claim a priviledge to disclose my experience for the publick benefits at my pleasure.

Secondly I affirm, that there can be no damage to any refiner, by the divulging of these secrets : but on the contrary, a great probability of much gain to that trade : for that, here is nothing, but the skill to make the assaies disclosed for the Searchers satisfaction, before he take in hand great workes ; which if you find cause so to doe, I advise him to chuse the best Workman that he can get, and one that hath been long experienced in these Workes and in so doing he shall prosper the better in his design : And if that every year some of the increase of that Trade shall be entertained in these affairs, as there is good probability they may ; the rest will have cause to give me thanks for my pains, rather than opprobrious speeches.

CHAP. V.

Wherein is shewed the Operation of Iron.

AS for the melting hereof, seeing that it is no work to be done in the Chimny corner, I will turn over the Reader to learn the practise thereof in every Country almost where he shall come.

As for the Refining thereof it may be done in this manner : Take filings of Iron two parts, Antimony one part, it will melt down like your Lead Oare : take the pure mettall, which will be much more brittle than the Lead was, and melt it with four times as much Lead as it weigheth, then refine it, as before is taught : if you know the goodness of your Lead before, you may know the augmentation out of the Iron, which will not quit the charges out of any Iron made in these Northern Countries, nor yet out of Spanish Iron : but what it may doe out of Iron made in the burning Zone I know not ; but I conceive it may doe well, if any such Iron can be found and made in that Climate.

It is true, that good gold may be extracted out of any Iron, but not by any common way, but by a tedious, laborious, and costly way : and when all is done, there will be no gain, unless it be in conceit, which satisfieth no man, but those who are of my disposition, which thinketh experience to be the greatest gain that can be in the world.

CHAP. VI.

Wherein is shewed the Operations of Copper.

First, take your Oare, and break it into little peeces, about the bigness of Hazell Nuts : then lay a Leere of small Char-coales an inch thick in your Chimny Corner : then lay on your peeces of Oar, then lay on more Char coales an inch and anhalfe thick upon the Oare, then kindle and let the fire burn out of it selfe.

Then beat it into small powder, and mingle it with your Sandiver, and Salt-Petre, as you did your Lead, without any filings of Iron, and so melt it down as you did your lead Oare : only this difference must be used, by reason that it is harder of fusion than the Lead Oare : therefore you must lay the bricks somewhat wider than you did for the Lead, that it may hold more Coals : besides that, you must take the choysfest Coals that can be picked out, and no very small ones amongst them : also you must have two paire of hand-Bellowes, and two men to blow very strongly, and so melt it down.

As for the refining it is needles to shew the manner ; for no Copper in these Northern Countries holdeth any royall Mettal, that is considerable ; neither English nor Danske Copper : yet in regard that in some Mines in *Hungaris*, there is generated Gold, Silver, and Copper, all in one mass of Oare : and also in regard that if any Mines of Copper shall be discovered in *Virginia*, or other Southern Countries, there is some good probability that it may contain royall Mettal : therefore I will shew the manner how to refine it, and also to part the Gold from the Silver, if it shall contain both together.

First, melt one ounce of Copper with four ounces of such Lead, as you know the goodnes of before : then refine it, and by the augmentation, you shall know the worth of the Royal mettall contained in the Copper.

If you would try whether the Copper contained any gold in it, put the assay, *viz.* the little Bead or Pearl of silver into good Aqua-fortis well purified before, and if all dissolve then the Copper held no gold ; but if it leave a black powder undissolved, that is gold : for Lead holdeth no silver that hath any gold in it at all : therefore it is evident that the Gold came out of the Copper.

But if it happen, as often as it doth in the refining of base Mettals, especially Tinne, Iron, and Copper, that the Little Bead, or Pearl remaining in the middle of the Test, is not bright and shining, like the eye
of

of a Bird, or Fish, but rough, black, and full of scurf; then if it be but a little in quantity, and that the Test be not cracked, nor full of clefts, then put to it some more of the same Lead, whereof you know the goodness, and drive it off again as you did at the first; and re-iterate this work till the assay be pure and clean like a little Pearl, or Bead, as it ought to be.

But if it happen that the Test is very foul, as often it cometh to pass in the Refining of strange Minerals, as *Marcasites*, and especially those which the Minerallists call by the name of *Devils Dirt*: Then there is no way but to let all cool; and then to dig it out, and with more Lead to melt it anew in a pot, and then to let it cool, and then to break the pot, and to beat off the Cynder with an hammer, till you come to the malleable Mettal, and you may be assured that no Royal Mettal will stay in the Cinder, but sink down into the Lead, through an attractive vertue betwixt them.

CHAP. VII.

Wherein is shewed the Operations of Silver.

AS for the melting thereof, when it is found in the Mire of Lead, the Operation is taught in the Chapter of the Lead: but if it be found by it self, or mixed with Gold without Lead, as many times it cometh to pass, then it is to be beaten to powder, and mixed with *Sandivere*, and *Salt-petre*, without any filings of Iron, and so melted down like the Lead Oar; only the fire must be somewhat stronger.

Then it is to be melted with four times as much Lead, whereof you know the goodness: and so to be refined, as before is declared.

But whereas sometimes this Oar is so strongly mixt with Sparre, and stony substances, that it cannot be separated therefrom, by any common manner of work used by the Refiners; then this course is to be taken with it: First, beat it into small powder; then wash away with water the greatest part of the terrestreity and filth: then dry the powder, and use it in this manner.

First, melt four ounces of Lead, and when it is melted put to it four ounces of quicksilver, made hot in another melting pot: but let the Lead be almost cold before you put to the Quick-silver: but yet it must be done whilst that the Lead is liquid.

This done, cast it into an Iron Morter, set warm before upon Embers,

and it will be like Pap; then presently with a Pestell, labour in one ounce of your powder, or two at the most, till it be incorporated; or so much thereof as will incorporate: for the strong and earthy substance will not incorporate with the Lead and Quick-silver by any Artifice whatsoever; but the silver, if any there be, will forsake the Earthy and stony substance, and joyn it self with the Lead and Quick silver by an attractive vertue. This done, put it altogether into a melting pot, with a little Sandiver and Salt-petre, and melt it down as you did the Lead Oar; onely this must be observed, that the fire must be more milde at the first a great deal, till the Quick-silver be evaporated, and more strong at the last, that all may flow well together. Then take out the pot, and let it cool; then break it, and with a hammer beat off all the Cynder and Scurf, till nothing be left but malleable metall.

Then refine it according to the common manner before declared, and cast up with your Pen the augmentation that is more than the Lead yeelded of it self: and if there be no augmentation, then that Mineral stone contained neither gold nor silver: for this is the most exquisite way in the world to reduce gold or silver, which is hard to be reduced to a metallical body, through being strongly mixed with either corrosive substances, or any other filth which hindreth his reduction: therefore if this way fail, you may set your heart at rest for the seeking out of any other devices whatsoever, though the glistering sparks contained in the said Minerals do never so strongly invite you; and you may conclude with the old saying, that all is not gold that glisters.

But if it prosper, and yields any augmentation that is considerable: then if you desire to know whether there was any Gold mixed with the Silver, as oftentimes there is, where silver is found without lead, then put the little bead, or pearl of silver, which remained on the Test into *Aqua fortis*, and if all dissolve, then there is no gold in that Mineral; but if a black powder remain, then that is gold, and the quantity may be found by further trial.

CHAP. VIII.

Wherein is shewed the Operations of gold and real experiments whereby any man may presently try whether any peece of gold be true or counterfeit, without defacing or altering the form thereof.

AS for the melting of it: if it be found mixed with silver Oar, as oftentimes it cometh to pass, then it is to be melted, refined, and parted from

from the silver with *Aqua-fortis*, as is before declared, and if there be not five times as much silver, as there is gold in the composition, then you must put to so much, or else the *Aqua fortis* will not dissolve it.

But if it be found in grains or powder, as oftentimes it is, then you must put to it *Borax* in stead of *Sandiver* and *Salt-Petre*, and so melt it down as you did the other Oars before mentioned.

Now for so much as this mettall is the most rich of all the rest, and most thirsted after, I will enlarge my Discourse for the gaining of means to find it out; also I will shew the reason why this Royal Mettall is many times found pure of it self, with little or no mixture of other base mettall with it.

And first, where as it is often found in the sand in Rivers, let no man think that it could be generated there, but that the swift motion of the water from the high Mountains, brought it thither, with earth and altogether, till such time as the motion of the water grew more slow; and so according to its property, being not able to carry forward still both the substances, did still carry the earth with it, and let the heavier body sink.

Therefore I would have those that have occasion to deal in the hot Countries where gold is usually generated, to make trial in all such Rivers which run from great Mountains with a swift course in such places, where the motion of the water beginneth to grow slow.

And for this purpose he may have a little Bucket of Iron that will not lye in the bottom, but on one side, which side must have a shoe like a shovel; so that being drawn a little forward, as it lyeth in the bottom it will fill it self with sand: which you may try by grinding it with Quick-silver whether it contain any gold: for if there be any gold in the sand, it will mix with the quicksilver willingly: then you may wash away all the sand, and strein the quick silver through a skin of Leather, and if any gold be gathered into it, there will remain a Ball in the Leather: then you may evaporate the quick silver from the Ball in a melting pot, and so melt down the gold with a little *Borax*.

Also sometimes gold is found in Rivers in powder and grains, far distant from any mountains of swift motion of water: this plainly demonstrateth that the earth thereabout containeth gold: a thing usually in hot Countries, and that the water in that place had a convenient motion to wear away the earth, and to leave the gold behind; and this is manifestly seen by experience where they wash whole mountains of earth with water, thereby to separate the gold from it.

Now whereas I have formerly affirmed that all mettals in general are generated of the clammy and glutenous part of the subterranean vapours,
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arising from *Bituminous* and *Sulphurous* substances, kindled in the bowels of the earth, it behooveth me to shew how gold, such a fixed substance can be found pure of it self, and not mixed with other base mettals.

And the reason of this can be no other, but because that all other mettals whatsoever will putrifie in the earth in length of time, and turn to earth again; but *gold* will never putrifie by reason of his *excellent composition*, being made of a *Balsamick Sulphure*, or fatnes, which is incombustible, and differeth from the *Sulphure* or *fatnes* contained in the other *metralls*, even as natural *Balsome* differeth from all other *Oyles*, & fat substances: so that though it be an *Oyl* in shew, yet it will sink in water, whereas all other *Oyles* will Swim upon the top of the water.

And this is the cause why *Gold* sinketh so eagerly in water, which may be proved by weighing a 20, *Shillings piece* of *Gold*, against his *Brass weight*, and then letting his *Scales* sink in a *Basin* of water 3. or 4. inches deep, the *Gold* will there over-weigh the *Brass* about 9. or 10. grains by reason that the *Brass* is more enclined to *swimming* through the combustible *fatnes* or sulphure in its composition; and as for the 20. *shillings Peece*, so for any other peece of *Gold* whatsoever according to its several *Brass* weight you may in like manner try whether it be true or counterfeit.

Now whereas the substance of *Gold* is not subject to putrifie in the earth by any length of time, it is probable enough that other mettals might be generated with it at the first, and afterward *putrified* and *consumed* from it in length of time, leaving the *Gold* pure.

For I have drawn *Iron*, or a substance much like to filings, or *atoms* of *Iron* out of grain *Gold* that was brought from *Gynnie* with a *Load-stone*, which seemed to be *Iron* not fully putrified and turned into earth.

And the Reason why the hotter the Country is, the richer the *Mine*-rals are, can be no other but the same, that roasted meats are sweeter than boyled Meats, or raw meats: the reason whereof is plain, for that the rawish and unfavory part is exhaled by the heat of the fire, leaving the sweetest part behind.

Even so in hot Countries, all that part of the subterranean vapours, which here is condensed into *Lead*, and other base mettals, can there have no leave to congeal, by reason of the heat: but is all or most part thereof exhaled out of the *Mines*, leaving behind the royall metals, whose property is to coagulate with heat: whereas the property of the base mettals is to evaporate with heat and to congeal.

The contrary opinion to this; namely that the substance of the best metals are convertible into Royal mettals by heat and digestion, hath filled the world with false Books and Receipts in *Alchemy*, and hath caused

fed many men to spend much money, labour, study and charges to no purpose.

For I know by good and long experience, and by many accurate trials that Quick-silver the most friendly *mineral* to the *Royall mettals*, can by no means or Artifice whatsoever be fixed or coagulated into either of the Royal Mettals: also I have found since that no Author of Credit or Reputation teacheth any such thing, but contrarily, condemneth all such operations to be false, vain, and frivolous.

For the matter of substance of the Royal mettals is quite contrary to that of the base mettals, even as the fixed salt of any vegetable is different from the *Volatill* or fugitive salt of the same. Yet I deny not but that by *Art* there may be drawn some small fixed part out of the base mettals, and may be converted into *Royall Mettal*, though with much labour, charges, and loss.

For as a Tree or other vegetable being burned, doth yield a fixed salt or Ashes: so the base mettals do contain in them some small quantity of matter of the same nature that the royall mettals are compounded of.

And for the further satisfaction to the Reader, I will shew in the next Chapter a true receit how to make reall and true Gold abiding all tryals, and having all properties active and passive which true natural Gold hath: but instead of gain, loss will be ready to follow the work.

CHAP. IX.

Wherein is shewed how true and perfect Gold may be made by Art with loss to the Workman.

Thus I Wrought.

I Took eight ounces of *Regulus* of Iron and Copper, made as beneath is declared, and 16. ounces of common *Sublimate*, bought at the Apothicaries, and made these ingredients into fine powder: first, severally and then I ground them well together upon a Marble stone, and so put them into a retort of Glass, and drew from them first an Oil, then a substance like a Butter, and lastly a yellow Sublimate, tinged with the tincture of Iron and Copper, which yellow Sublimate I rectified three or four times, till it was very pure: then I mixed it with equal parts of an *Amalgam* of silver, and quick-silver, made as beneath is taught, and put it into another retort of Glass, and forced away all but the silver, which remain-
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ed like yellow horn: this yellow silver I *Amalgamed* again with new quick-silver, and set it in gentle heat about a week, then in very strong heat for 6 houres; so that the *quick-silver* rose up, and fell down again upon the silver; till such time as that it had carryed up all the silver; from the botom of the Glasse into branches like trees, then I melted down the silver; and fined it, and parted it with *Aqua-fortis*, and had divers grains of pure and good gold abiding all tryalls: but the quantity would not pay for half the charges and labour.

I made the *Regulus* thus: I took 4 ounces of Iron in stub nails, and made them red hot in a crufible: and then I put to it 8 ounces of *crude antimony*, and melted it down, and when it was well and thin melted, I let it cool in the pot, and so knockt off the *regulus* from the lop or cynder, which lay upon the top of it, then I did the like with 4 ounces of Copper in thin plats: and then I mixed equal parts of these two, and melted them 3 or 4 times, every time casting into the pot half an ounce of Saltpetre, as it was in melting to purifie it, till it was pure and bright almost like Silver, but yet brittle: so that I could beat it in a Morter to fine powder.

The yellow silver that was like yellow horn, did *Amalgam* with much difficulty and grinding, with salt and Vinegar, and some of it was lost do what I could: but the first silver was water silver, which I bought at the refiners, out of which they had taken all the gold before: this did *Amalgam* very easily, then I strained it to a Ball through a Leather skin, and so mixed it with the yellow sublimate that was tinted yellow with the tincture of Iron and Copper.

The proportion of the quick-silver to the silver was 5 or 6 parts to one.

If any one doubt the truth of *Alchemy*, he may be satisfied by this triall; but in stead of gain he shall pay for his learning, by going away with loss.

I do not deny but there are works of less loss and charge, yet none of them lucrous by reason of the change of times.

For if any one will uphold me as good a lease; or purchase of land, as I can prove by credible records, hath bin had in former times for an ounce of gold, I will undertake to make an ounce of gold by Art to pay for it, and yet have a good bargain.

But the difference of times hath confounded this Art, as may appear more plainly beneath.

First, in ancient times a mans work was not worth above a penny a day, which now is worth two shillings six pence a day, as may appear
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by ancient records for buildings, and the like: so that there is thirty to one loss in the Workmanship.

Secondly, then coales, vessels, and other things necessary for these affairs did cost little, in respect of the charge now.

Thirdly, when the gold was made, it would then have bought thirty or forty times as much, either Lands, leases, victuals, or workmanship as now.

So that I conclude, that then the owners of this Art might gain 30. or 40. for one, and yet now they shall loose extreamly.

The cause that moved me to search so much into these affairs, was, because I saw by the books, that so divers men in divers ages, and in divers Countries did agree in one tale; whereby I conceived it impossible to be a lye, now I conceive it might be true, but that the times have made an alteration.

CHAP. X.

Wherein is shewed the Operations for some of the inferiour Mineralls.

AS for these base Minerals, viz. *Cinabar naturall, Antimony, Sulphur, Auripigment, Arsenick, Talcum, Muscovy glass, Emery*, and many other things of like nature, because they are of small value, and not worth the seeking for on set purpose, I will omit further to discourse of them: if any man shall find them, or any of them, by accident, let him use his own pleasure, skill, and industry in the proceeding of them.

Nevertheless, because *Cinabar naturall* may contain much quick silver, which is very useful for many things; and may prove as beneficial as a good Mine of mettall, especially if it shall be found in great plenty: I will therefore shew the *refining separation*, and *purifying* of the same in small proportion: so that if it shall be found a *profitable* work, then the finder thereof may proceed to a greater work. The first thing then to be done, is to consider of the weight thereof: if it be very ponderous, reddish in colour, and full of clear streaks, shining almost like the streaks of *Antimony*, then it is a good sign of a rich Mine.

The first trial to be made thereof is to weigh a peece thereof, and so put it into a gentle fire for an hour or two, in such sort that it may only be red hot; then to let it cool, and to weigh it again, and so by the lightness thereof, being compared with the former weight, you may judge somewhat of the richness thereof.

Then take a pound thereof, and beat it into fine powder, and mingle it well with as much unsleekt Lime, put it into a retort of Glasse, luted with Potters clay, and some horse-dung well beaten and tempered together; then set it in a little furnace in your Chimny corner, and force it with fire 12 hours: let it be kept red hot the last 4 hours, and let the nose of the glass enter into another glass, filled almost full of water, in such manner that the vapours of the *Cinabar* must needs enter into the water, for the better condensation thereof into quick-silver.

This done, separate your quick silver in the bottom of the water, and drie it, and weight it; if you find the quantity considerable, then you may proceed in this manner.

First, make an hole in the earth with very good tempered clay that will hold water, and let it be narrow in the bottom, and wider and wider above to the top, to the breadth of 2. or 3. or 4. yards; then fill the pit with water, and lay over it barrs of iron of sufficient strength and thickness to bear the burden that must lye upon it; and let them lye so near together that the stones and wood cannot fall through: then lay thereupon a leere of dry wood, and a leere of your red stone not broken small, and so do again till it be a yard thick or more, then give fire to it on the wind side, and go away out of the danger of the fumes, till you see afar off that the fire is finished and burned quite out.

Then repair to your work, and let out the water through a pipe of Lead, which should be formerly laid almost at the bottom of the Pit, and into another pit near to it, made so deep that it may receive the water, and in the bottom you shall find great store of quick-silver, if the Mine was good.

The water may be pumped up again to serve the next day for the same use; and you need but to take up but a few of the bars of Iron every day to go down into the pit, to take out your quick silver, and so lay them down again.

CHAP. XL.

Wherein is shewed the waies to find out Pit-coales: also the naturall cause of the generation of them, by a plain demonstration.

THough this Mineral be of small value, yet if a good Mine thereof shall be discovered in some particular places of this Land, the benefit thereof will far exceed the profit of any metall Mine usually found in these

these Northern Countries, by reason that wood is so greatly decayed of late years, that were it not for this help many People would be in danger to be starved.

The first thing therefore which I would have to be diligently observed is; that this Mineral is usually found in ground that is proan to bear wood and thorns, and not in the very fertile grounds, nor yet in the extream barren grounds, but of an indifferent fertility, and in grounds that are usually slower in their groweth in the Spring time, than the fertile Champion countries by a week or a fortnight.

Also the said grounds are proan to bring forth large Cattell, and well horned: but not to feed the said Cattell without a long time, nor yet will they ever be very fat upon the same ground. Also the springs issuing out of the said grounds, are apt to colour the earth ruddy at their Orifice, like unto the rust of Iron.

Also the said spring water being boiled as before is taught, doth usually yield a black residue.

Also if you burie a new bowl of pure white wood in the said grounds, from *March* till *Midsummer*, with the Mouth downward, it will be coloured blackish, with the subterranean vapours.

Also I had a receipt given me for this purpose by one, that for his great experience, and excellent skill in natural causes, seemed to be one of *Natures Darlings*: which because I have not tryed, for want of opportunity, I will commend it as a very probable sign, and give such Cautions, that any man may be sure of it, before he trye his fortunes by digging or boaring, or any chargeable way.

And this was his direction: *about the middle of May, when the subterranean vapours are strong, which may be discerned by the Firm, which about that time will suddenly grow out of the earth in a night or two, almost an handfull in length, then take a pure white peece of Tiffany, and wet it in the dew of the grass, which is all of that springs growth, and not soyled with cattel, nor no other thing, then wring out the dew from it, and do so five or six times, and if there be coales the Tiffany will be a little blacked, and made fowl with the sooty vapours arising through the Coales and condensed amongst the dew.*

Now to be sure not to be deceived, do thus: first trye it where there are coales, and if ye find the signs abovesaid, yet trust not to the experiment, till you have tried where there is no Coales in some other place, wherein it behoveth you to try in divers places, till you find a place where the Tiffany is not soyled at all; then you may be sure that the experiment is true and unfailable.

I admonish him that shall trie with the *Tiffany* upon the dew, to let his hands

hands be *washed* before with Sope and hot water, and wiped with a pure white cloth, till they will not foul the cloth at all; else if they spend their *money* in *digging*, and find nothing, they may thank their foul fingers for that misfortune.

As for the naturall cause of the generation of Coales, this demonstration following doth make it manifest.

Take a peece of the black fat earth, which is usually digged up in the West Country, where there are such a multitude of Firr-trees covered therewith, and which the people use to cut in the form of Bricks, and to dry them, and so to burn them instead of coals; use this substance as you did the other earth in the beginning of the Book, to find out the natural cause of Rocks, Stones, and Mettals, and let it receive the vapours of the cumbustible substances, and you shall find this fat earth hardned into a plain coal; even as you found the other lean earth hardned into a stone.

Whereby it appeareth that nature doth the same thing in the generation of Coals under the ground, by the indurating of a fat earth with the subterranean vapours which are apt to work a various effect, according to the substance which they meet withall.

Now whereas some of inquisitive dispositions will desire to know the natural cause of that fat earth, generated in such *subterranean* Cavernes, let them be pleased to consider that such places in former times have been the superficies of the earth, and afterward have been covered by the sea with other earth, which may be demonstrated by two wayes: first, it is evident that the Mines of Coals do ly in some places, higher, and in other places lower, lively resembling the *superficies* of the earth, which is never directly equal, but every where various.

Secondly, every one may see in the *West Country*, where such a multitude of Firr trees do ly covered so deep in the earth, that the superficies of the earth was deeper then it is now in former ages, when those trees were brought thither by the Sea: for it is evident that they never grew there: first, for that there groweth no Firre trees in that Countrey: secondly, for that they do ly cross, and in such uncooth manner, that no humane strength could ever imitate nor paralell by any device whatsoever.

Also they may see the power of the Sea to alter the superficies of the earth, by the multitude of earth there laid so many yards deep upon the top of the trees.

Also they may see that the Sea doth make the difference of the nature of earths by its various motion, as well as the unevenness thereof by hills and vallies: for there they may see that some earth will burn, and some will not burn, being both sorts brought thither by the Sea, as appeareth evidently by the former discourses.

Also

Also the Sea never resting, but perpetually winning land in one place, and losing in another, doth shew what may be done in length of time, by a continual operation, not subject unto ceasing or intermission.

CHAP. XII.

Wherein is shewed a perfect way to try what colour any Berry, Leaf, Flower, Stalk, Root, Fruit, Seed, Bark, or Wood will give: also a perfect way to make colours fixed, which will not abide the ordinary way.

HERE I must confess a manifest digression from my subject: yet in regard of the great benefit which this experiment may bring to the Countrey out of the new Plantations, and other places, where it is very probable that many of these things be hidden and unknown, I will crave pardon, for that my intent was chiefly to prevent the loss of those things which may do much good, were it not through ignorance or negligence.

First then take half a pint of water, and half a pint of float, made as beneath, 2, penny weight of *Allom*, 12. grains of *Tartar* finely beaten, and put all into a *Tinn* vessel, which is better than *Earth*, *Lead*, or *Copper*; set it on a *Trivet* to dissolve the *Allom* upon a gentle fire: as soon as it beginneth to boil, take a peece of white wollen cloth, well scoured with *Sope*, fullers earth, or *Lee*, or altogether, to take out the grease of it, being well washed out with fair water, and then dryed in the air or Sun, not by the fire: the cloth must weigh but half an ounce; then tie a thred to the end of the cloth, and when the *liquor* beginneth to boil, then put in the cloth, and let it boil an hour; then take out the cloth, let it cool, wash it in two or three waters; then take any berry, leaf, flower, stalk, root, fruit, seed, bark, or wood, and bruise them well; put them in fair water, and boyl them with a gentle fire to extract the tincture; then put in the cloth formerly prepared, which will shew what Colour they will give.

To make the Float.

Boyl an Hogs-head of water, then cast in a Bushel of wheat Brann, then draw the fire, then let it stand three or four dayes, till it grow sowerish.

But for small tryalls a little will serve, observing proportion between the water and the Brann.

A proportion must be observed in the allowing of all stufes before they receive their colours: First, the proportion of *Allom* to the water; which is one of *Allom* to 16. of water, and float: Secondly, the proportion of the

Tartar

Tartor to the *Allom*; which is one of *Tartor* to 4. of *Allom*: Thirdly, the proportion of *Allom* to the Cloath, which is one of *Allom* to five of the Cloath.

Note that all silks must be allomed cold, or else they will loose their luster.

The way to find what tinclure is hidden in any vegetable, or in any part thereof.

Take the vegetable, being cut green, and stamp and grind the same, as if it were to make juice thereof, then press out the superfluous moisture; the remainder make up in Balls, and lay them up together, that they may gather a little heat, but let them not heat to much, for then they will turn to dung: these being sufficiently fermented, must be dried, and afterwards used as Oad is used.

Another way as Indico is made.

Make a pit with Timber and boards, about a foot deep, and as wide, and as long as you please, being well clayed in the bottom and sides; then fill this pit with any vegetable cut green; then put as much water to it as will cover the herbs: let it stand exposed to the Sun two or three daies: then with a plugg at the bottom draw out all the water, and cast it away: then fill the pit again with fresh water, and when it hath stood the like time, draw it away as the former: this do so often, till you find that the herb will be easily brought into a mussilage; then it must be trod, and beaten with wooden instruments, like rammers, till it will come all to a mussilage: then it must be taken and wrung through hair Sives, like *Cassia Fissula* extracted, to keep the stalks and great Fibres for passing through: afterwards the Mussilage or papp that passeth through, must be dried in the Sun, and so formed into Cakes like to Indico.

Another way.

Take the vegetable cut green, and stamp and grind it: then take an Hogs-head and fill it with half water, and half bruised herbs, set it out of the Sun, with the bung hole open two or three inches, till it firment and work like Wine or Beer: after it hath done working the Herbs will sink, which at the first did swim, and the liquor will grow a little sowerish; then let it be set abroad in the Sun, and brought into Vinegar, as wine and beer is brought into vinegar, and then that colour can never be stained with other Vinegar or Vrine, because it is sufficiently impregnated, and his appetite satisfied with his own proper Vinegar: when his substance is thus turned into Vinegar, the clear Vinegar must be drawn from it, the remainder must be used as the former Indico, and some water to that, to be sure to fetch out all his tartarous mussilage, must be put to the Vinegar, and dried away in the Sun, and so they come like Indico: *In tincluram tartarizatum.*

tartarizatum.

savtarizatam fixam de occulto in manifestum.

And whereas Barks, Woods, and Roots are of a dry composition, and will not firment of themselves with water like green Herbs, or vegetables: therefore they must be well ground, or thinn shaven and there must be added in stead of Water, Juice of Grapes, Pears, Apples, or Wort made of Malt, or other grain, into which the Wood Bark, or Roots must be put: let them ferment together, and afterwards be turned into Vinegar; then the clear Vinegar must be extracted: the residue of the tincture must be extracted with fresh water, and both of them must be breathed away in the Sun, as before, and so brought in his perfect tincture.

By this which hath been declared in this Chapter, it may appear to every one having an inquisive disposition, what is the true naturall cause why some colours are fixed, and will not stain with vinegar, urine, nor yet fade with the Air; which hath in it a certain acetosity, or sharp airy salt of the nature of Vinegar, which those tinctures draw to them, which have not their Appetites fully satisfied before with such spirituall or airy salts; and this is further manifest for that all such tinctures which are moist firm and fixed, and are not subject to staining or fading, being tasted upon the tongue, may be felt somewhat sharpsish or sowrish.

And the cause of this appetitive and attractive vertue in colours is no other but the very same which is betwixt the Load-stone and Iron: for take the Load-stone, and burn it till all his blew vapour be exhaled, and then he will draw no more Iron: thereby shewing plainly, that it was that airy salt, tincted with the venerall, or vegetable greenness, which the Iron thirsted after, to satisfy his thirst and dry nature and constitution, which he got by his calcination and fusion.

And the like attraction may be discerned by the intellectuall eyes, in any thing that is strongly burnt, so that all his Spirits are exhaled: as Lime will draw the airy substance to him, and thereby quench himself: Also Tartar burnt, and laid in the Air, will draw the sharper part of the air to it, and thereby dissolve it self: and in summ all corporeall substances, the more they have lost their spirituall parts by naturall, or artificiaall operation, the stronger is their Attractive vertue.

Now in stead of filling the Readers head with Proclamations, I will conclude my Book with giving ease to his memory, by prescribing what necessities he is to provide for the accomplishing of his severall designs, in his Voyages or Plantations, whither his occasion shall draw him.

And first for him that will only try his fortunes in the searching for Mineralls.

He will need nothing but two or three Pipkins, two or three Vrinalls, an Iron Pick-Ax, well iteeled, a Spade and a Crow of Iron, if he will be at the

the charge thereof: but there is no great necessity: also if he be not acquainted with the several Oars of Mettalls, it will be convenient that he take with him a little peece of every sort of Oares: or so many severall kinds as he can get.

And for him that would proceed further, to try the value of them himself, he must provide these things following.

A Grate of Iron of a foot broad, some Bricks, two pair of good hand-bellows, a pair of Tongs some Lead, Salt-Peter, Sandiver, Borax Flanders melting Pots, a ring of Iron for the Test, an Hatchet, or hand-saw to cut wood: some good Aqua-fortis, Weights and Scales: and if any man be not active handed, he may have a Man for a trifle to shew him the Manuell practice in a day before he go his Voyage.

And for him that will search for Dying stufes, he may see in the last Chapter what things he shall stand in need of: Also the other Chapters may be perused whereby every one may be the better accommodated for their severall enterprises.

T H E T A B L E.

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| CHAP. 1. wherein is shewed by a plain demonstration the naturall cause of the generation and production of Mountains and Mettalls: whereby the Seekers may obtain a good competent measure of knowledge to guide them where to seek for the other external signs. | Page. 1. |
| Chap. 2. wherein is shewed the signs of Mines and Minerals, with the manner how to work to find the same. | p. 4. |
| Chap. 3. Now that we are come to the melting and refining of Mettalls, I will begin first with the Oar of Lead, because that is one of the most common Mettalls found in these Northern Countries. | p. 6. |
| Chap. 4. wherein is shewed the operations for Tinns. | p. 8. |
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